MAY 1985 • Volume 8 • Issue 5

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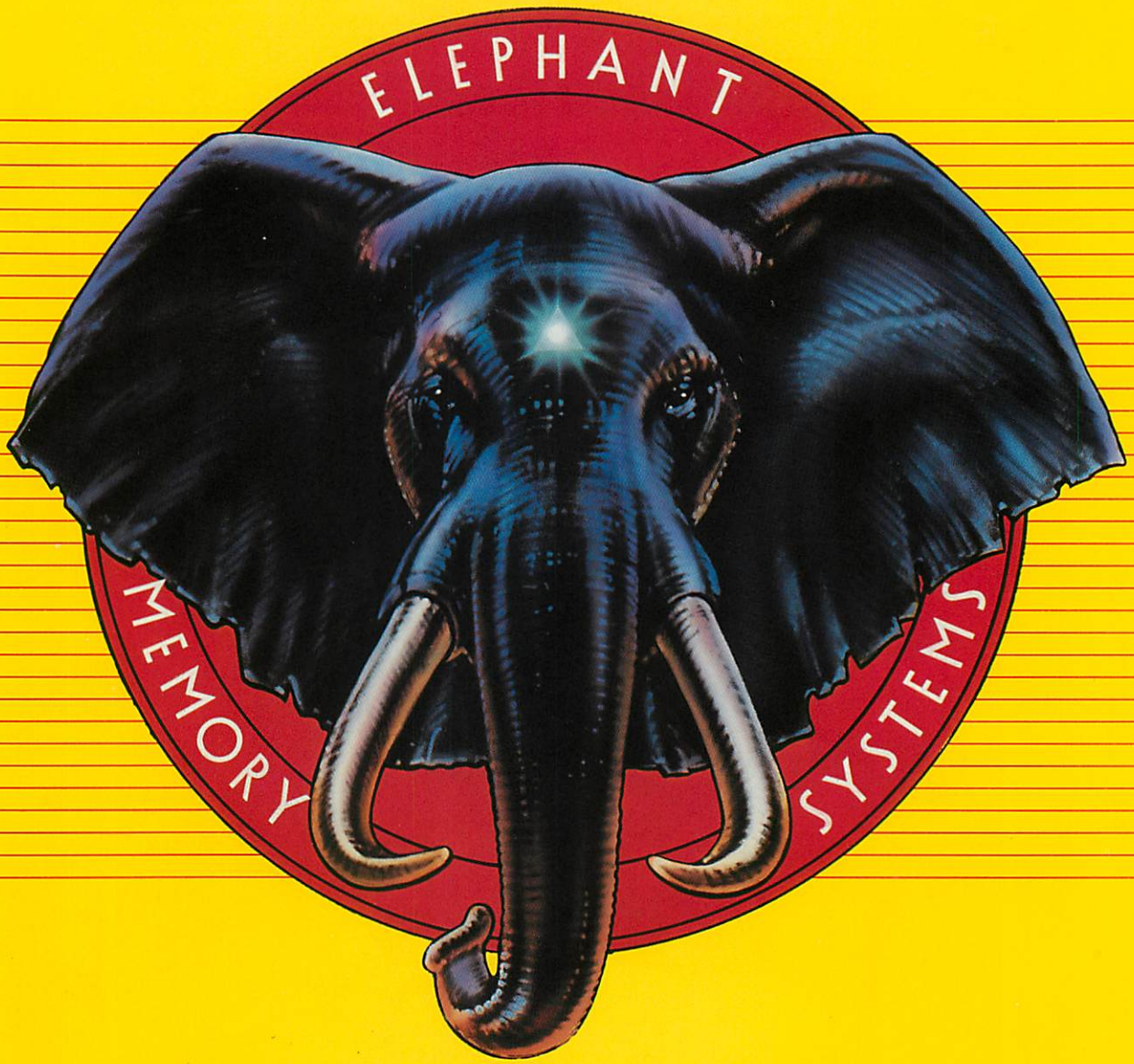

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COVER STORY

MONEY PROGRAMS

In this special 11-page section we look at the ways money meets the micro. Consultant *Mike Lewis* explains what to look for when choosing an accounts package, with special reference to the popular Sage program — see page 110. *Chris Bidmead* explains how user friendliness has finally come to accounting, through the use of graphics and the mouse — see page 116. Finally, *Glyn Moody* provides an invaluable guide to on-line financial services from stock prices to BACS — see page 118 **109**

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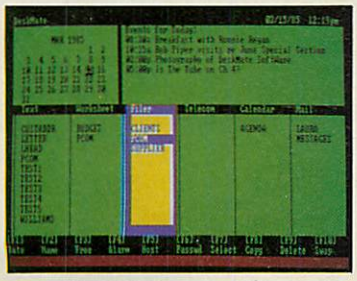

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CAN IBM GO SOLO?

THERE'S A LOT of loose talk about at the moment. People who ought to know better are asking daft questions. The major one concerns the possibility that IBM will somehow shut the rest of the industry out of the world's most profitable microcomputer business — the one that surrounds the IBM PC.

The staunchness of this magazine's long-established support for the PC does not mean we are blind to IBM's real position in the micro world or, indeed, to the relationship of the business micro to the rest of the computer business.

IBM's Personal Computer has become dominant not because IBM imposed a standard from outside, but because it adopted the best of what the micro industry had to offer in the summer of 1981. As we discovered when dismembering our first twin-floppy IBM PC, almost none of it came from IBM. The chip came from Intel, and both the operating system and Basic from Microsoft. Everything else except the keyboard, the case and that famous copyright ROM had been bought in from established microcomputer companies.

This is not to criticise or belittle IBM's contribution. IBM did exactly the right thing, and has been well rewarded for its open-architecture approach. It also got the microcomputer business out of a mess by providing solutions to three problems.

The first problem was the 5.25in. disc, which in micro-computing rapidly took over from the 8in. size. The advantage of 8in. discs was that the format was standard, and most sensible machines could read any single-sided single-density disc. With 5.25in. discs we had a semi-standard operating system — eight-bit CP/M — but a Tower of Babel in disc formats. Half the machines had problems reading their own discs, let alone anyone else's. What IBM did was establish a de facto 5.25in. standard, and now even 16-bit CP/M micros feel obliged to read IBM PC-DOS discs. That's good.

The second problem was that CP/M had run out of memory. The 64K limit meant more and more programs would not fit into RAM, and had to be written using overlays, like WordStar. Overlays are a pain. They slow down the program and involve continual disc access. The large address space of the Intel 8086/8 chips provided the room for bigger and better programs.

The third problem was that many micros looked as if they were assembled by amateurs for amateurs: the whole industry had a Heath-Robinson feel to it. IBM produced a piece of office equipment you weren't ashamed to have on your desk.

Now the needs of the marketplace today are for more of the same: more standardised operating system and disc formats, more address space, and more powerful, more reliable office equipment. Those are the needs IBM's AT is designed to satisfy, and that is why it will prove to be a major product. What the market does not need is an exclusive IBM operating system — or, indeed, an exclusive OS from DEC, Data General or any other Johnny-come-lately.

Companies which have tried to impose one have failed to secure any lasting share of the market at all. The same thing would happen to IBM, as it well knows. Not even the world's largest computer company has the resources to produce a new software package a week for a single machine, and without software support the hardware is useless. The IBM EX/PC would be left stalled in an alley while the rest of the MS-DOS market motored along without it.

IBM did not create the microcomputer business: companies like Apple, Microsoft and Digital Research did that. IBM does not drive the market forward: software writers, magazines and real users do that — and have done it for 10 years now. But perhaps these facts are not fully appreciated by the dinosaurs just stumbling in from the stagnant, swamp-covered land of the mainframe.

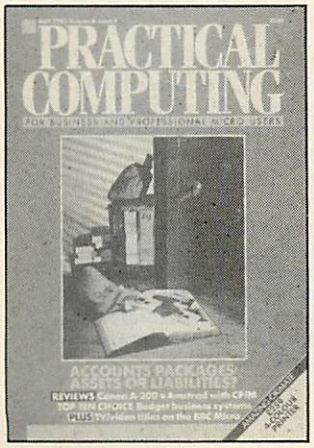
The mainframe manufacturers got their come-uppance through not taking minicomputers seriously. The mini-computer firms were left stranded when they missed the boom in micros. Now that microcomputer companies are becoming the status quo, they are equally vulnerable to any innovator who offers more power for less money. It can happen here.

5 YEARS AGO...

Good news for anyone still confused by the chaotic state of the law of copyright — a London barrister and programmer, Alistair Kelman, has drafted a Bill to give explicit protection to computer software and has started a campaign to have the Bill introduced before Parliament.

Some support for the Bill has already been drawn from Sir Keith Joseph, Secretary of State for Industry, and Phillip Vergo, Secretary of the Conservative Computer Forum, although the Civil Service still holds the view that the matter is less than urgent. A Green Paper will be published in May which will examine the whole area of copyright, without necessarily giving much attention to computing.

Kelman's Bill has been drafted to amend the Copyright Act of 1956 and is designed to tackle the following questions: Are Computer programs copyright works? If a copyright work is converted into digital impulses is this an infringing act under copyright law? Is output from a computer a coyright work? Can work written with the aid of a computer have a copyright?



Cover feature page 109.
Photo: Tony Hutchings.

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PUBLISHED by Electrical-Electronic Press, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS. Tel: 01-661 3500. Telex/grams 892084 BISPRS G.
DISTRIBUTED by Business Press International Ltd, Quadrant House, The Quadrant, Sutton, Surrey SM2 5AS.
SUBSCRIPTIONS: UK £15.50 per annum; overseas £23.00 per annum; selling price in Eire subject to currency exchange fluctuations and VAT; airmail rates available on application to Subscriptions Manager, Business Press International Ltd, Oakfield House, Perrymount Road, Haywards Heath, Sussex RH16 3DH. Tel: (0444) 459188.

Printed in Great Britain for the proprietors Business Press International Ltd by Greenaway Harrison Web Offset Division, Southend-on-Sea. Typeset by Lithotype Design, London EC1.
©Business Press International Ltd 1985
ISSN 0141-5433

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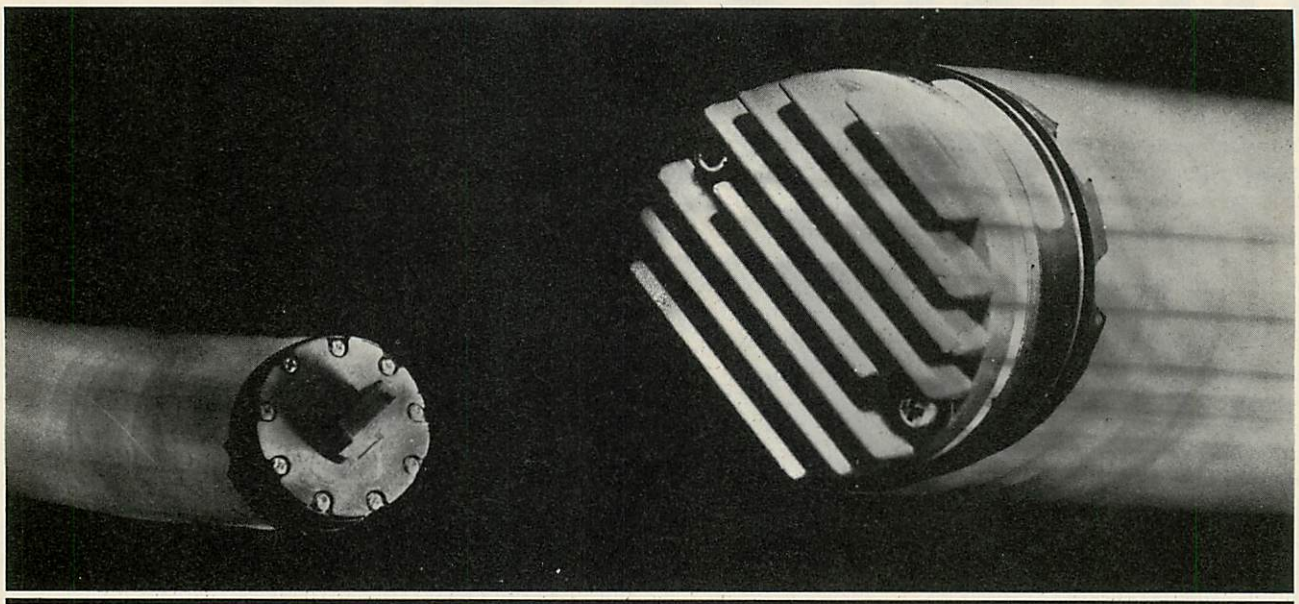

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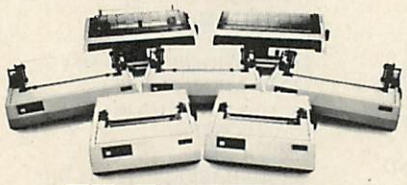

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Feedback, Practical Computing,
Quadrant House, The Quadrant,
Sutton, Surrey SM2 5AS

Project-Planning Software

I WAS INTERESTED to read in your March 1985 issue under the heading of "Superproject" for IBM News, that the great minds of the software houses are starting to focus on the sales potential of project-planning software for micros using network-planning techniques.

As a consultant R&D planning engineer of some years' experience, I have in the past been appalled by the poor standard of the facilities offered by commercial software based on network techniques and sold for use on micros, generally at a very high price. I might add that I have also seen some pretty bad examples on mainframes too. One can only suppose that some of the people who wrote these programs had had very little experience of running actual projects since the programs did not cater for the requirements of a planning engineer controlling a project on a day-to-day basis.

I recently had the opportunity to assess one of the latest offerings in this field in terms of both software and hardware. Whilst I appreciated the speed and ease of input of a strictly limited amount of data using all the new facilities available, the program could just not do many of the fundamental things that a project-planning engineer needs to be able to do — and quickly.

After using a good old 32K Pet, suitably programmed, for some years — I've moved on to CP/M now — for controlling high-cost R&D projects I was left with the distinct feeling on this latest machine that the programmers were really constrained by the vast amount of memory consumed by the graphics at the expense of the purpose of the program itself — in other words, a profligate waste of good memory.

I sincerely hope that the race you forecast, to produce a WordStar or DBase II equivalent in this field, will produce some new and more realistic software products which take proper account of the parameters used for planning a project, both in terms of time and cost, not forgetting that there are still a large number of eight-bit micros around that people feel comfortable with, both in the manager's office and on the factory floor.

RICHARD C READ,
Camberley,
Surrey.

IN BUSINESS WITH THE QL

YOUR MARCH EDITORIAL issue on Basic includes a comment about the 128K RAM of the Sinclair QL. It all sounds great, and the marketing hype about this very advanced business machine with the in-built ring connections and soon-to-be announced hard-disc unit persuaded me to order one as a potential replacement system for my company's stand-alone microcomputers. The four Tandy model 1s and the Sirius 10Mbyte units were getting long in the tooth anyway and here was the perfect solution — low capital cost with high performance and interconnection too!

The reality was very different. Even so, I struggled on with learning Sinclair's version of Basic and learned to cope with colour; then started writing a parts-explosion program as one step in a total manufacturing-control system for our light-engineering works. Although exasperated by the inability to scroll and stop the program wherever I wanted and then restart, the program took a lot of shape by early December and was on course for the January 3 deadline.

Then came a refusal to boot up. An urgent phone call to Camberley brought the answer to return it and they would send one back in 10 to 14 days. A long telex message to Sinclair Research explaining the position and asking how we could get our hands on a working QL within 24 hours went unanswered, just as another a week earlier asking for help with printing was ignored. I was forced to scrap 20 hours of work and rewrite the programs for our Tandy units, and they are now up and running.

When the repaired QL was returned, I took it home for my 14-year-old daughter to use, and also for me to use the word-processor program Quill. Now, I can return to the start of this letter, the 128K memory. On my steam-age Tandys the dated Scripsit is used very happily by six or more office staff who each have their own disc and use any of the four machines that is free. With Scripsit, there is no question of typing ahead as an excuse for slowness, as with Quill; and to print the finished result all that is needed is to press Break, then P then Enter and away goes the daisywheel printer.

What do I find with the state-of-the-art Quill? Press f3, press P, press Enter, press Enter, press Enter and then the most amazing thing happens: the Microdrive whirs into action for a second or two — presumably to load the printer driver — and only then does the printer burst into life. With this massive 128K memory, why dip into the Microdrive to load the printer driver with resulting delay and additional wear of the moving parts?

It appears to me that the design flair which suited first-time users, who would automatically follow the dictates of the enthusiast designer, is an impediment to the design of a business machine for more experienced users who have a yardstick of other equipment and programs to judge by. Surely, a knowledge of business practice is essential before designing computer equipment for small-business use. Sinclair's inability to answer letters or telex messages indicates the need for business training before letting design engineers loose on a drawing board.

MELVILLE BERNSTEIN,
Chairman, Daryl Industries Ltd,
Wallasey,
Wirral,
Merseyside.

Dyslexia programs

EVER SINCE 1979 the Mayfield Computer Dyslexia group has been producing programs to aid teachers and parents with dyslexic children. All programs are in the public domain, but there is a small copying charge of £5 for some 20 to 25 programs, depending on the computer.

We cover Pet and Commodore 64, disc only; RM 380Z and 480Z, disc only; BBC B and Electron, disc or tape; Spectrum, tape or Microdrive; Amstrad CPC-464, disc or tape. There are programs for left/right confusion, short-term memory, diagnosis and mathematics, as well as spelling. All spelling programs are of the Data type which can have vocabularies altered easily.

The group has recently started programs to aid the Adult Literacy Scheme, initially for BBC Micro and Spectrum only.

A large stamped addressed envelope will bring further details.

BROTHER HENRY,
Mayfield College,
Mayfield,
East Sussex TN20 6PL.

Foreign-language programs

THE ARTICLE "Foreign Talk" on page 106 of the February issue of *Practical Computing* gives the false impression that modern-languages software is still firmly in the stone age by implying incorrectly that interactive video is a development that lies in the future, and that the computer's contribution to modern-languages teaching is confined to text.

Although this is the case on the home front, it is far from true in relation to computer applications in modern-languages teaching in educational institutions. Groups and individuals in many of these have taken up the challenge of the computer despite the Luddites in language teaching, many of whom are still deeply suspicious of such dangerous innovations as coloured chalk.

It certainly is not true that Look and Type is the only option open to the computer-assisted language learning programmer. In the Department of Modern Languages in the University of Dundee, my colleagues and I are trying to dent the frontiers of

(continued on next page)

(continued from previous page)

knowledge with the aid of the Tandberg TCCR-530 computer-controlled cassette recorder which, in place of the conventional mechanical counter, boasts an on-board software-driven clock.

Through an RS-232 interface the recorder can be controlled by computer not only in all the normal functions — Play, Record, Stop, Wind, Rewind, and even Eject — but also can be made to wind to a specified time, play from one specified time to another, and sense the presence or absence of audio on the tape for a specified duration, which makes setting up audio blocks a relatively easy task. Given fast wind and rewind times and a location accurancy of ± 0.5 seconds, this is a powerful tool indeed in language teaching, which I can assure your reviewer is not just a twinkle in the researcher's eye.

At the current rate of progress in computing, it may not be long before such advances find their way from the classroom into a wide range of educational and non-educational applications.

PROFESSOR R W LAST,
Department of Modern Languages,
University of Dundee.

LSL Logo

MAY I CORRECT one point made by Susan Curran in her review of our BBC Logo? We have no quarrel with Acorn Computers. Our "negative acknowledgement" to them is not vicious: it's a joke, dammit! Perhaps we should have made this clear to over-earnest reviewers by adopting historian A J P Taylor's practice of inserting "(goak)" after each quip.

CHRIS SQUIRE,
Logo Software Ltd,
Twickenham,
Middlesex.

Safe, easy backup

THE LETTER in your February issue from J McNally of Compaq Computers prompts me to refer to an absolutely vital but heavily under-reported aspect of microcomputing. This concerns the need to provide the business user with a completely reliable and fast method of copying the data on the computer's mass storage devices, whether floppies or hard disc.

Mr McNally is right to say that a tape streamer is one of the most useful features that could be offered to the typical business desk-top user. Indeed I would go so far as to say that it is infinitely more important than mice, blinding speed, windows or the most esoteric piece of integrated software.

Computers in the legal profession are a good example. Solicitors must keep account of large sums of clients' money as well as their own costs. Many of the systems currently being offered to medium-sized legal practices provide data backup via floppy discs.

Depending on the system anything from five to 15 discs may have to be used at the end of each day in an operation taking as long as three-quarters of an hour to complete. Apart from being a gross waste of staff time, over 40 discs could be involved if three disc sets are in use.

The opportunities for Murphy's Law are obvious. To begin with it is certain that sooner or later such a tiresome and time-consuming chore will be neglected, perhaps just for a day at first and then, nothing dreadful having happened, for longer periods.

The day comes, however, when the practice is burgled, or there is a fire or, most likely of all, the disc crashes. At this point the solicitor finds out too late that his backup has not been kept up to date and he faces the situation of having lost track of his clients' financial records.

The solicitor and his staff will now be forced to contact clients, the banks, insurance companies, building societies, the Land Registry and HM Customs and Excise — to mention but a few! This process will cost a fortune in time and money and do the reputation of the practice no good at all.

The fast and reliable tape streamer avoids all these possibilities. The device takes a mere five to seven minutes to copy and verify a year's work or more. The data is then securely stored on one small, well-protected package. The advantages, for any business, are obvious.

GEOFFREY BARKER,
Computers in Practice,
Penarth,
South Glamorgan.

Speed freaks

PLEASE COULD Boris Allan write another article suggesting improvements to Benchmarks with the deliberate mistake taken out? Because of the way that they were designed, the times for Benchmarks 1 to 7 are obviously going to be correlated, as almost every feature to be tested is added into a previous Benchmark.

The times which could be independent and useful are:

BM1 — Tests the For loop, which may be used for delays. It also reflects the basic compilation speed as only one reserved word is interpreted per iteration.

BM3 – BM2 — Tests simple arithmetic on variables.

BM4 – BM2 — Tests simple arithmetic on literal constants; a comparison of these two figures shows the consequence of Sinclair's conversion of literals to binary at entry time as against Microsoft's conversion at run time.

BM5 – BM4 — Tests the overhead involved with the use of subroutines.

BM7 – BM6 — Tests the speed of array assignments.

BM8 – BM2 — Tests the speed of series evaluation for maths functions.

Given the above, the individual times should be correlated, but Boris Allan's comments about the mean still seem justified. As I understood the original argument, however, the hypothesis was that any average is meaningless since it will not reflect the frequency with which a real program uses each operation.

People still seem to insist on a single figure to show overall performance, so while the arithmetic mean is as valid as any other statistic, it was chosen because is at least easy to compute. Anyway, simple assignments and tests — the over-weighted processes — are more common than trigonometry, so they should be weighted more heavily.

ROGER BEAUMONT,
Keighley,
West Yorkshire.

I WAS THRILLED to see Boris Allan's "Speed Freaks". It has been clear to many readers that *PC*'s standard eight Benchmarks are biased towards certain simple operations and are inadequate measures of modern micros.

As I read through the article I had the first impression that this was a serious and well thought-out attempt at the difficult problem of benchmarking, but I later realised that the statistical veneer covered fundamental flaws in his reasoning. He failed even to follow up the good point that he made in his opening paragraph that "important aspects such as numerical accuracy are ignored".

(continued on page 13)

SO YOU'RE THE TWIT WHO REPORTED THE ERROR IN THE ACCOUNTS PROGRAM....
MUCH AS I ADMIRE YOUR VIGILANCE AND LOYALTY TO THE COMPANY...
... DON'T YOU THINK YOU COULD HAVE WAITED...
... UNTIL MY MONTHLY SALARY CHEQUE FOR £23,748 HAD GONE THROUGH MY BANK ACCOUNT?!!
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MITCH

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COMPUTER SYSTEMS LIMITED

Symbiotic Computer Systems has been at the forefront in the development of mass storage and networking products over the past three years designing and manufacturing systems to enable the full range of **Apple** microcomputers to form a business facility, powerful enough to rival many mini-computers on the market.

Symbfile – Symbiotic's Winchester hard disk system can now be used with both the **Macintosh** and the **Apple*IIc*** as well as the **Apple II** range. The Symbfile is available in capacities up to 42 megabytes – enough space to store about 25 thousand pages of data! which can be accessed at extremely high speeds and contained on much larger volumes than even the highest capacity floppy disks.

Symbnet – the Symbiotic tree and branch local area network, allows up to 127 computers to access one Symbfile. Symbnet is one of the few commercially available network systems that uses fibre optic technology. Fibre optic cable is unaffected by electrical interference and can run up to 9 Km between stations with no degradation of signal and can now also be used with low cost twisted pair cables for distances up to 30 metres. This allows the user to mix both fibre optic and twisted pair cable to suit their exact requirements, providing one of the most cost effective and noise immune systems available.

Symbstore – is the answer to secure back up; it utilizes inexpensive cassettes each capable of holding 10.5 Megabytes of data, that can be used quickly and efficiently to stream a complete Symbfile image to tape. The full range of Symbiotic products are also available on the **BBC Micro.**

The Symbiotic group of Companies distribute their products through a wide network of dealers covering virtually the whole of western Europe.

For more details contact one of the following Symbiotic group companies –

Symbiotic Computer Systems Ltd	Duroma House, 32 Elmwood Road, Croydon, Surrey CR9 2TX, England. Tel: 01-683 1137 (PBX) Telex: 928202 SYMPLC
Symbiotic Computer Systems (Benelux)	Keizersgracht 26, 5611. GD. Eindhoven, Netherlands. Tel: 040 456055
Symbiotic Computer Systems France	2 Rue Henri Chevreau, 75020 Paris, France. Tel: 349 06 80
Symbiotic Computer Systems A/S	PO Box 354, O. Tryggvassons 4, 7000 Trondheim, Norway. Tel: 07 53 20 27
Symbiotic Computer Systems Inc	PO Box 1431, Fairfield CT 06430, USA. Tel: 203 374 5910

The complete solution...

winchester sub systems · local area networks · tape streamers

● **Circle No. 105**

If you thought great achieve look at the Fujitsu Micro 16s.

NASA did it for over £150 million – the Fujitsu Micro could manage it for under £2000*.

On 21st July 1969, Neil Armstrong was the first man to set foot on the moon. A great achievement in the history of mankind.

But if you thought great achievements had stopped 16 years ago, think again. Fujitsu's great achievements in mainframe computers, telecommunications, integrated circuits and micro computers have earned us a reputation for innovation, design, quality and reliability – in short, we are Japan's number one computer company.

And we'd like to announce another one of our great achievements – the remarkable Fujitsu Micro 16s. Because, in terms of computer performance, what was possible within the computing complex at NASA on that momentous day can be managed now by the Fujitsu Micro 16s.

The FM16s offers total computing flexibility in a comprehensive system which can be expanded to a full, five terminal multi-tasking, multi-user configuration with the minimum of hardware redundancy.

Equally at home (on earth) with businessmen or scientists alike, the FM16s runs under the latest implementation of Concurrent CP/M and offers the benefits of not one but two additional operating systems, CP/M 80-86 and MS-DOS.

And at under £ 1,950* for the entry level business system, including four top-flight software packages to get you started, Wordstar, Supercalc 2, Personal Basic and GSX Graphics Extension it won't cost you the earth (around £ 150 million less than the NASA computer complex, to be precise).

* Price as at April 1985

FUJITSU Mikroelektronik
MICRO COMPUTER SYSTEMS
Hargrave House Belmont Road
Maidenhead Berks SL6 6NE
Tel: 0628 76100 Telex: 848955

富士通

ments had stopped, take a

Fujitsu Micro 16s

Both 16 bit and 8 bit processors for 16 and 8 bit software programs.
Multi-user (up to 5 stations).
128K Byte RAM expandable to 1MByte.
Two 5¼" Floppy Disk drives, IBM format.
Graphics capability.
Several operating systems including Concurrent CP/M-86, MS-DOS 2.11, CP/M 80/86, Wordstar, Supercalc 2, Personal Basic, GSX and documentation.

Note: The following trademarks are registered:
Wordstar - Micropro International
Supercalc 2 - Sorcim/IUS Micro Software
CPM, Personal Basic, GSX - Digital Research Inc.
MS-DOS - Microsoft Inc.

● Circle No. 106

Send today for your personal presentation pack on the Fujitsu Micro 16s.

Name _____
Position _____
Company _____
Address _____
_____
_____
Tel. No. _____

FUJITSU

FUJITSU MICRO COMPUTER SYSTEMS
Hargrave House Belmont Road
Maidenhead Berks SL6 6NE

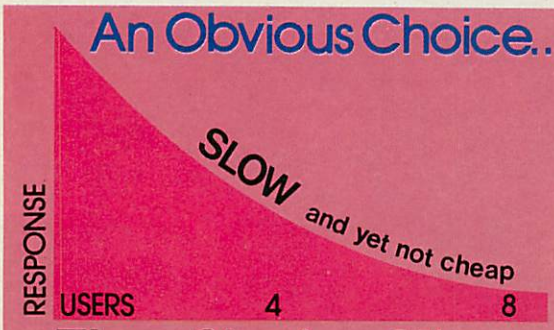
INTEGRATED, HIGH PERFORMANCE, EXPANDABLE & COST EFFECTIVE

Multi-User Computer

STOP PRESS!
IMPOS now supports genuine multi-user MS-DOS as well as Concurrent CP/M 3.1, CP/M 2.2 and CP/M 86 simultaneously in any combination for up to 16 users

LOOK AT YOUR CHOICE OF TECHNOLOGY BEFORE CHOOSING YOUR MACHINE

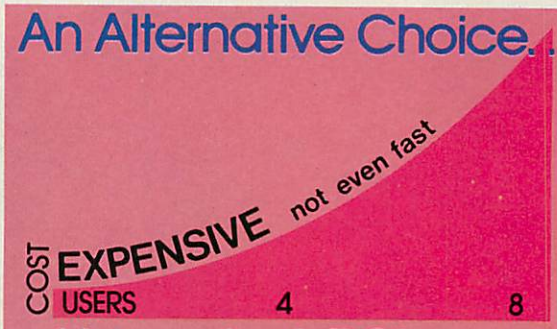
An Obvious Choice...



Time Sharing Micros

Typical multi-user micro machine are doomed by CPU degredation being based on time-sharing principles. Altos, Fortune and IBM PC/AT are in this class.

An Alternative Choice...



Networked PC's

Networks are too expensive and tedious. They do not offer a truly integrated multi-user system or speed. Networked IBM PC's and Apricot are such examples.

The Wise Choice...

Multi-Processing

The choice you didn't know you had . .

In Multi-processor SuperStar, each user has its own dedicated processor with up to 1Mbyte of RAM each, working at full CPU speed regardless of the number of terminals. The tremendous increase in power resulting from having up to sixteen 16-bit processors compared with time-sharing a single processor must be plain. Because it is a network on an internal bus, it is very much faster than conventional serial networks — yet it is much less expensive because all the processors are integrated into one desk- top unit instead of being distributed among the various PCs

SuperStar is a genuine multi-user system with record/file locking and with printer spooling. All MS-DOS and CP/M (all variants) programs run without modification. It is ideal for a cost-effective Office Automation system for any or all of the following functions in any combination.

- ★ *Word Processing and Spread-sheets*
- ★ *Database and Information Management*
- ★ *Telex, Electronic Mail and Communications*
- ★ *Genuine Multi-user Data Processing, such as Stock Control, Order Processing, and Integrated accounts.*

Rather than slow time-sharing micros or expensive networked PC's more and more companies are choosing multi-processing to meet their multi-user requirements, including:
BUPA*, BRITISH TELECOM, HILL SAMUEL*, MORI, PHILIPS*, MONSANTO, SOUTHAMPTON UNIVERSITY, BROMLEY HEALTH AUTHORITY, BANHAM ALARMS* AND MANY MORE.

*Case studies of their installations are available on request.

SuperStar is a trade mark of Bromley Computer Consultancy. CP/M is a trade mark of Digital Research. MS-DOS is a trade mark of MICROSOFT.

BROMCOM
PIONEERS IN MULTI-PROCESSOR TECHNOLOGY

417-421 Bromley Road, Bromley, Kent BR1 4PJ
Tel: 01-697 8933 Telex 896691 TLX1RG

SuperStar-16 has a 16-bit Master Processor which runs IMPOS (BROMCOM designed true 16-bit controlling operating system). IMPOS supports CP/M, MS-DOS and shortly Xenix in slave processors in any combination and it is fully upward compatable with ACTION DPC/OS, Televideo MmmOST and TurboDOS.

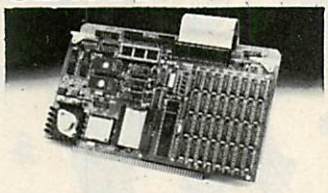
● Circle No. 107

ADVERTISEMENT

JUST LAUNCHED! MULTI-USER MS-DOS

MS-DOS is an established 16-bit operating system for a single user PC. BROMCOM has incorporated MS-DOS 2.11 into SuperStar-16/MS to offer a genuine multi-user environment through multi-processing. This development opens the door to a tremendous opportunity for exploiting the widely available applications software developed in MicroSoft Basic (MBASIC) which can run only under MS-DOS in 16-bit. Record and file locking are fully upward compatible with Televideo MmmOST, DPC/OS, TurboDOS and MP/M. Floppy disks are compatible with IBM-PC and full PC-DOS compatibility will be available early in 1985.

16-BIT MASTERS/ SLAVES



In a given configuration, say 8-users (maximum 16 — more with networking), SuperStar has eight 16-bit slave processors, each with up to 1Mbyte RAM, and an additional 16-bit Master processor also with up to 1Mbyte RAM. All processors are iAPX186 with optional 8087 co-processors. This demonstrated the immense power and capacity of the system against time-sharing systems where a single processor serves all eight (or more), users. SuperStar's multi-processor architecture also enables each user to choose his own different operating systems environment, e.g. CP/M or MS-DOS — one more of the superior features that cannot be found in other systems.

INTEGRAL 1/4in CARTRIDGE TAPE BACKUP

SuperStar-16 has an optional tape backup facility, totally integrated in the system and built into the desk-top unit.

SuperStar-16 must be one of the most powerful, flexible and complete systems available on the market.

For information see opposite page.

(continued from page 8)

Benchmarks are used to help a group or an individual evaluate a product according to their needs. Benchmarks in a large-circulation micro magazine such as *PC* must try to anticipate the needs of their readers, an extremely difficult task. Dr Allan's approach takes two Benchmarks only, one of which, Benchmark 8 has the five-line inner loop:

```
500 K=K+1
530 A=X^2
540 B=LOG (X)
550 C=SIN (K)
600 IF K <1000 then 500
```

Thus this Benchmark is approximately 60 percent trigonometric, logarithmic and exponential functions. Since he gives equal weight to his two Benchmarks, 30 percent of his total Benchmark is made up of such statements. When I look over the tens of thousands of lines of Basic that friends, colleagues and I have written for micros, I doubt that three percent of lines executed are of these types.

It may not be possible to cover fairly all classes of statements in a widely accepted subset of Basic, but an improvement on the original eight or Dr Allan's two Benchmarks cannot be difficult.

PETER FINCH,
Control Data,
Brussels.

THE EDITOR REPLIES: *Practical Computing* has always warned that these Benchmarks are not very useful. However, they are used by several magazines on both sides of the Atlantic, and this enables comparisons to be made beyond a single magazine. We would be interested to receive Benchmarks from readers to test the operations suggested, plus the speed of writing to the screen.

IRS-Dialtech

IN THE TABLE of database hosts on page 104 of the March 1985 issue, our entry contained some inaccuracies or omissions.

We support access at 300 or 1,200/75 baud, and via PSS, at 1,200 duplex. Our U.K. users number 1,300, but globally the ESA-IRS service offered by the European Space Agency is used by over 6,000 password holders. IRS-Dialtech is the U.K. national centre for ESA-IRS.

Our address is Room 392 Ashdown House, not as stated room 232.

ROY KITLEY,
IRS-Dialtech,
London SW1.

Two-column WordStar

I READ with amazement "Two-column text from WordStar" in the February edition of your magazine. Surely the simplest way to produce multi-column text from WordStar is first to type text in one column and then use column block moves to paste together the column? Provided you keep a copy of the text in its original one-strip state, editing is no problem either.

WordStar has a somewhat unjustified reputation for being difficult to use: articles like this will only serve to propagate this myth.

NICK MALDEN,
Oxford Data Systems,
Oxford.

JOHN LEE REPLIES: The method you advocate, using the column move facility, is described in the last part of the article. As someone who actually uses WordStar for creative work, rather than selling it or talking about it theoretically, I do not find this the best solution, nor is it a method which is universally applicable.

It takes a long time to prepare a document in multi-column format using block moves. If you then find an error near the beginning, it is impossible to reformat the multi-column page after making the correction, and it probably alters the paging. You have to start at the beginning on the single-column version and repeat all the block moves a second time. I was caught out once preparing the index for a book like this, and never again!

I am reluctant to use column moves very much, since there is a bug in the code in my version of WordStar that just occasionally locks the system, and hence loses the document, since the only solution is to reboot. The bug only appears when column move is switched on, and we think it may be when you go outside the normal margins. I have corresponded with Micropro about this; the problem is not limited to my particular copy. If I use Column On, I do the move and put Column Off as soon as possible.

Remember also that column moves were only introduced with WordStar version 3.0 and the very many users of WordStar 1.X, 2.0, 2.1 and 2.2 have no way to do it, so it is not universally applicable. Many computers sold with packaged software still use version 2.2.

Like you, I too believe that WordStar is not difficult to use, but the documentation is another matter. That for WordStar 3.3 is an improvement, but I felt so strongly that an excellent product was spoilt by the documentation that I spent a whole year writing a book *WordStar and CP/M Made Easy*. The sales were enormous, which confirmed my view on the documentation.

NEC 8201a User Group

WITH REFERENCE to John Laidlaw's letter in the March Edition of *Practical Computing*, the matter of a 8201a User Group is presently under discussion with NEC.

I would be pleased to forward information to any users or prospective users of what is a far more practical solution to "Computing on the move" than many other machines costing twice the price.

Send a stamped addressed envelope for full details.

MIKE WITHERDEN,
Unit 12,
48/50 Norwich Avenue West,
Bournemouth,
Dorset BH2 6AW.

THE EDITOR ADDS: There already is a user group for the three Kyocera machines: the Tandy 100, NEC 8201a and Olivetti M-10. It publishes Kyocera User Newsletter, subscription £12 per annum. Contact John L Noyce, PO Box 450, Brighton, East Sussex BN1 8GR.

Keystrip

MANY THANKS for publishing my Keystrip program for the BBC in the March issue, page 125. When using the program the other day, I realised that I had not included a statement to reset the printer before using the print facility.

This problem can be solved by inserting the following lines into the program as it stands.

```
405 REM reset printer
406 VDU 2,1,27,1,64,3
```

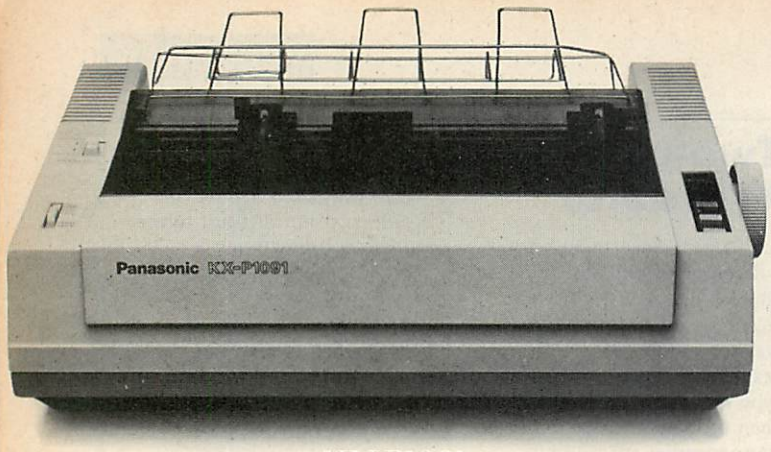
Also, I forgot to mention that disc users would have to run the program from lower in memory. This is achieved by entering

```
PAGE=&1100
```

followed by

```
CHAIN"fSTRIP".
```

MICK GLOSSOP,
London W12. PC



KX-P1091

The KX-P1091 and KX-P1092 are the first computer printers to bear the Panasonic name.

Our name has always stood for quality and reliability. These products certainly live up to it.

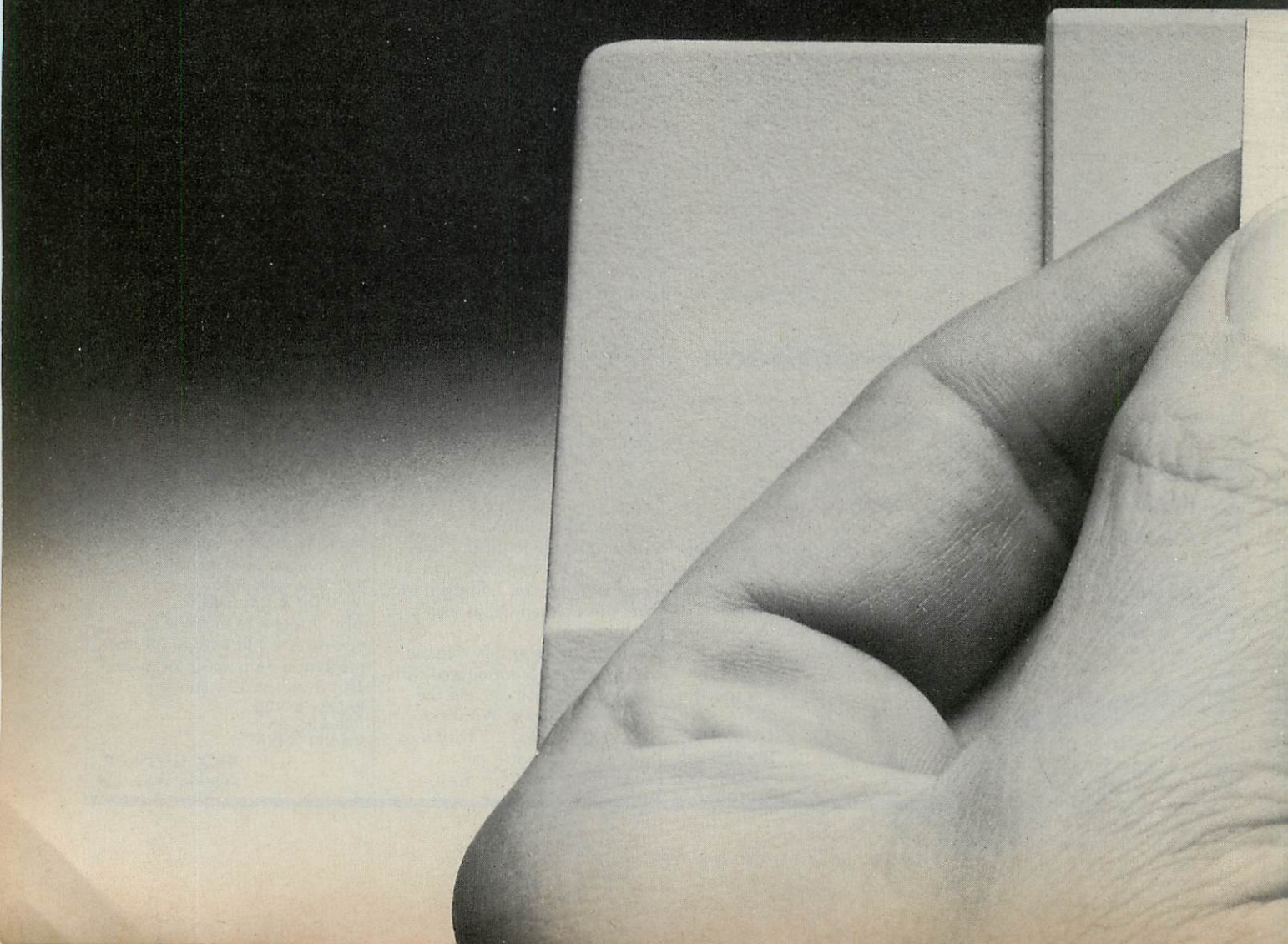
Both give excellent Near-Letter Quality and have the built-in advantage of a type mode switch for quick and easy mode selection.

The KX-P1091 comes equipped with a 1K memory and delivers a speed of 120cps.

While the KX-P1092 is ideal for the busy small business. It boasts a top speed of 180cps

PANASONIC INDUSTRIAL UK LTD., 280-290 BAT

WE'VE JUST GIV
PRINTERS A



and a superior 7K memory.

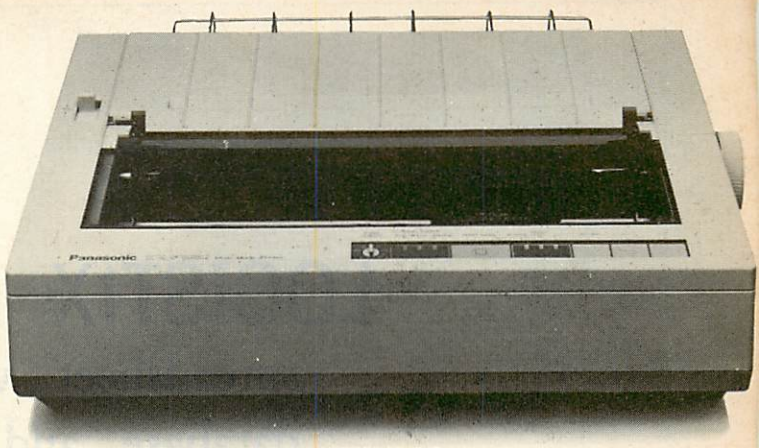
Which simply means you can leave it to get on with your print run while you get onto your microcomputer.

Why not give your business a good name?

The Panasonic printers are available now from your nearest computer dealer.

If not, ask your dealer to contact Datac, Norbain Micro, Northamber plc. or Vistec for immediate delivery.

Panasonic
Office Automation OA



KX-P1092

RD., SLOUGH, BERKS. SL1 6JG. TEL: SLOUGH 73181.

● **Circle No. 108**

EN COMPUTER GOOD NAME.

LOGISTIX (n) a powerful spreadsheet with an extensive database and containing truly superior presentation-quality graphics. *Logistix also includes:* the fourth dimension — (1) time management; (2) resource allocation; (3) task scheduling; (4) project planning. Commonly referred to as *'... the best idea in business software since the spreadsheet'.*

THE INDISPENSABLE PLANNING AND DECISION AID

No business remains static. You need to know not only what is going on today, but what should be happening next week, next month or next year. So you need the right kind of information in a form you can use and understand, you need to be able to analyse it in various ways and you need to be able to present it to others. Most important of all, you need to make decisions about the future. In short, you need to plan.

Logistix adds the all-important feature of time management to classic spreadsheet features, an extensive database capability and presentation quality graphics, to provide a versatile, powerful and easy to use planning and decision aid for managers and professionals.

LOGISTIX – The best idea in business software since the spreadsheet.

- ▶ DATABASE
- ▶ TIMESHEET
- ▶ SPREADSHEET
- ▶ GRAPHICS

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● **Circle No. 109**

Fujitsu wages war

FUJITSU has entered the educational market price wars with a 20 percent discount on retail prices on the FM-16S machines for educational establishments.

The entry-level system will cost £1,540. For this price you get an 8086 running at 8MHz, 128K RAM, two 360K floppies and a monochrome monitor. A colour screen costs an extra £160.

The 20 percent discount applies equally to all software products for the FM-16S machine. There is currently no time limit on the scheme. More details on (0628) 76100.

Amateur Robot Association

AMATEUR ROBOT Association Ltd, an independent umbrella organisation for users of personal robots, is moving to 5 Queens Street, Haverhill, Suffolk CB9 9DZ. Telephone: (0440) 707072.

Membership currently stands at 2,000. Subscriptions vary from £4.50 per annum for individuals to £35 for affiliates, which caters for group memberships such as schools.

Black Box's Crypton

CRYPTON is a data link scrambler from Black Box. Two units are required, one at each end of the link. A unique password is encoded into matching pairs, providing hardware-based security, since without the corresponding unit at the receiving end, it is not possible to decipher a transmission. It is also possible to restrict access to certain parts of systems by giving users different levels of privilege according to the code of their descrambler.

The Crypton links up with micros via the serial port, and has its own built-in power supply. Each unit costs £275. More information can be obtained on (0734) 866800.

Three new hard disc options are available for the Apricot XI.

APRICOT UPGRADES XI

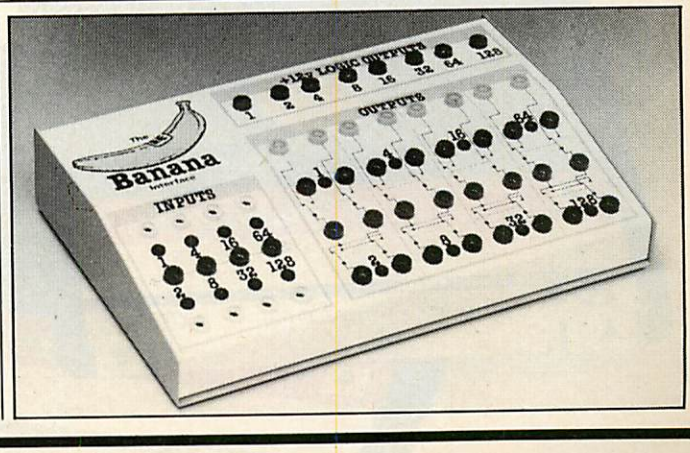
ACT has launched three new models at the upper end of the Apricot range. All three machines come with more RAM and bigger floppies as standard compared with previous machines.

The XT-10S has a 10Mbyte 3.5in. Winchester and a 720K floppy, with 512K RAM. The XT-20 has a 20Mbyte hard disc with 512K, and the XT-20S has the same Winchester and floppy but a full 1Mbyte RAM. All models include two spare expansion slots, and can be linked into the Apricot network systems.

The XT-10S costs £3,295, the XT-20 £3,795 and the XT-20S £4,295. All prices exclude screens and VAT. More information from ACT (Holdings) plc, ACT House, 111 Hagley Road, Birmingham B16 8LB. Telephone: 021-454 8585.

The Banana

THE BANANA interface allows machines like the BBC Micro to be used in a number of robotic and control applications. Deriving its name from the banana sockets it uses, the Banana can control various types of d.c. motors and relays. The unit costs £175, and can be obtained from Castle Associates Ltd. Telephone: (0723) 584250.



Concurrent Advance

THE ADVANCE 86B can now be upgraded to run Digital Research's CP/M-86 and Concurrent DOS. Although any 86B can be upgraded, the response for floppy-disc systems is sluggish. Ferranti is recommending concurrency only for machines with third-party Winchesters.

One bonus is that IBM PC compatibility is enhanced. For example, Ferranti says that Symphony will now run on the Advance. The new board also incorporates a socket to allow an 8087 maths co-processor to be added.

The board costs £159 as a factory-fitted option. NAS Ltd, which provides national maintenance for the Advance, offers an on-site upgrading for £165. Ferranti is on 061-499 3355; NAS Ltd is on 01-568 8855.

Liberator

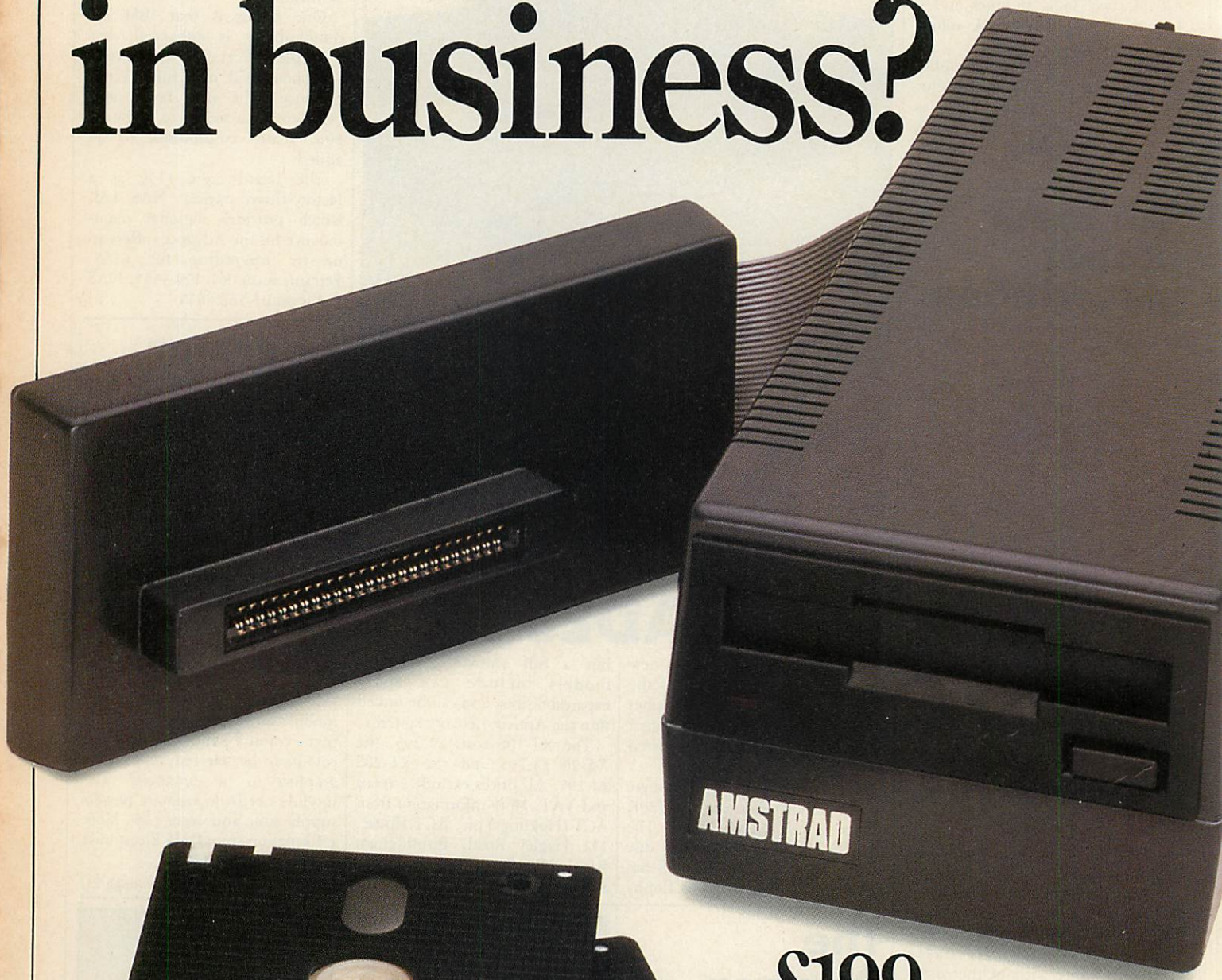
THORN EMI has launched the Liberator, a 3.5lb. lap portable, costing about £700. The British-built machine has a 80-by-16 LCD in the standard flip-top format. The overall size is about A4, and it is 1.5in. thick. The basic machine comes with 48K RAM, and a serial interface is standard. Details on (0443) 435273.

Peacocks and Apples

THE PEACOCK is an RGB colour module for the Apple IIc. It allows text colours and background colours to be selected, and colour graphics to be enhanced. The module needs no separate power-supply unit and costs £76. More information from DMS Electronics Ltd on (0909) 773399.

(more news on page 21)

Have you got the drive to succeed in business?



£199

DD1-1 disc drive (with CP/M* and DR. LOGO*) and interface.

£159

FD-1 additional disc drive.

Running any business successfully means first running it efficiently.

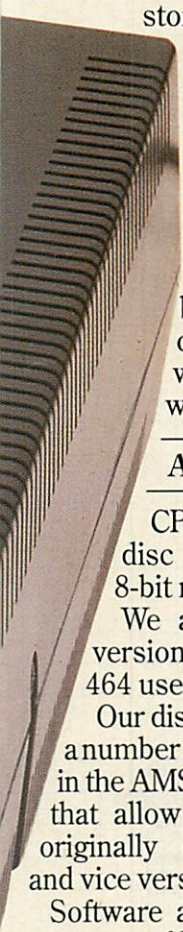
And no matter how business-like you think you are, you can't beat the power and convenience of a random access CP/M* disc system.

Now, with Amstrad's CPC 464 computer, you can enjoy all the advantages of a 3" disc drive complete with an integral power supply and plug-in interface controller.

Naturally, you can add a second drive (FD-1) to double the on-line storage capacity, speed up copying files and producing back-up discs.

But of course, simply plugging a disc drive into a computer won't get you very far.

That's why Amsoft have produced a disc based software range of over 30 programs with many more on the way.



AMSDOS and CP/M*

CP/M* is *the* standard disc operating system for 8-bit microcomputers.

We also supply a special version of DR. LOGO* for CPC 464 users.

Our disc drive system includes a number of extensions to BASIC in the AMSDOS operating system that allow the disc to use files originally created for cassette, and vice versa.

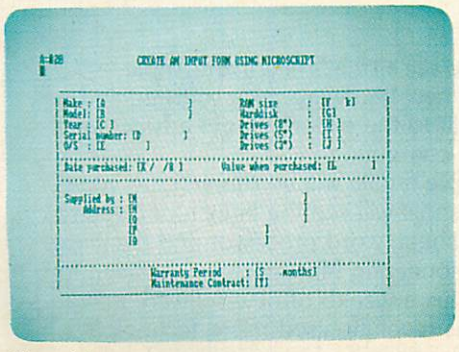
Software also takes care of the necessary file management so that CP/M* files can exist alongside these AMSDOS files.

Data files may even be shared between AMSDOS and CP/M*.

Word processing, data management, accounting, ledgers – you'll find an AMSOFT program to suit whatever kind of business you want to do on your CPC 464.

There's even a range of programs that teach you professional business practice.

Incidentally, you can exchange your Amsoft cassettes for identical Amsoft disc software for a mere £4.95 per cassette (the cost of a blank disc).



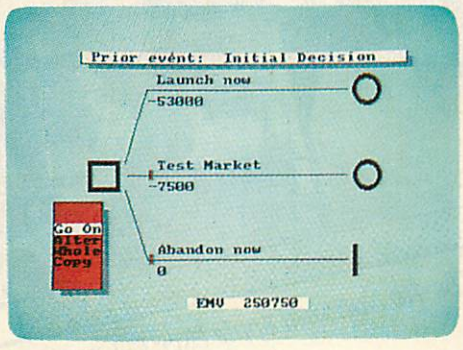
Microscript

£239

complete with green screen VDU (GT64) and FREE software pack worth over £100.

£349

complete with colour monitor (CTM640) and FREE software pack worth over £100.



Decision Maker

CPC 464.
Really gets down to business.

At the heart of it all, of course, is the incredible Amstrad CPC 464 computer.

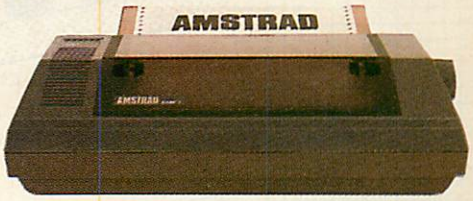
The CPC 464 has a typewriter-style keyboard, large ENTRY key, sensibly positioned cursor keys, numeric keypad for fast data entry and a full 8-bit character set.

It provides high resolution graphics, 80 column text display, up to 8 text windows plus a graphics window and a palette of 27 colours.

There's also a built-in Centronics standard 7-bit parallel printer interface. So you can enjoy high performance word processing with the printer of your choice.

The CPC 464.

It does whatever you want it to do. But that, of course, is your business.



Optional 80 column dot matrix printer DMP-1. Operates at up to 50 characters per second.

AMSTRAD

ONE GREAT IDEA AFTER ANOTHER

BOOTS COMET Currys Dixons
Greens John Menzies RUMBELOWS spectrum
WHSMITH WIGFALLS AND OTHER COMPUTER STORES

*CP/M and DR. LOGO are Trade Marks of Digital Research

I'd like to know more about the businesslike CPC 464 complete computer system.
Please send me literature right away.

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ADDRESS

POSTCODE

To: Amstrad Consumer Electronics PLC, Brentwood House, 169 King's Road, Brentwood, Essex CM14 4EF.

PRICES CORRECT AT TIME OF GOING TO PRESS. NOT ALL STORES STOCK ALL PRODUCTS.

PC 9

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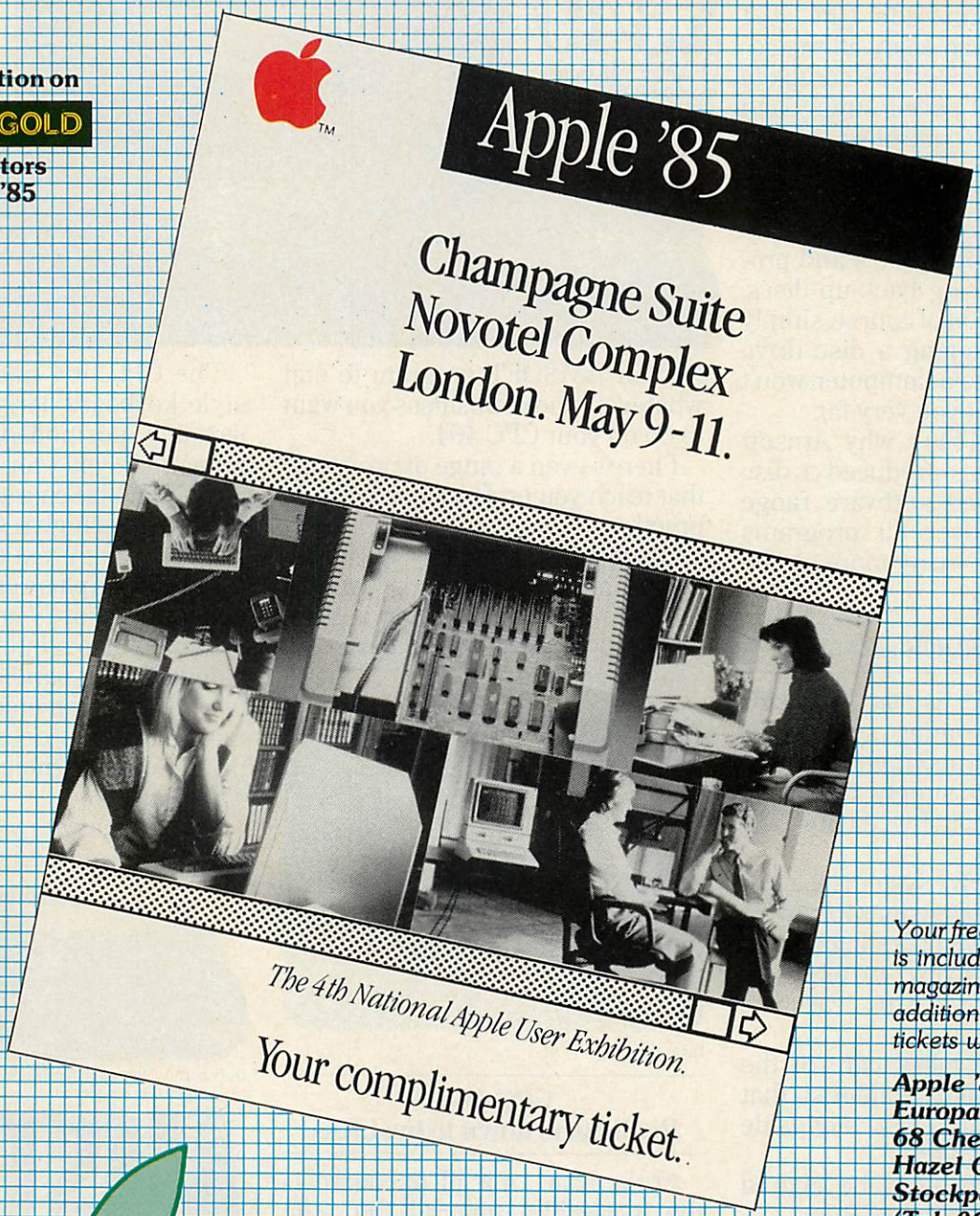

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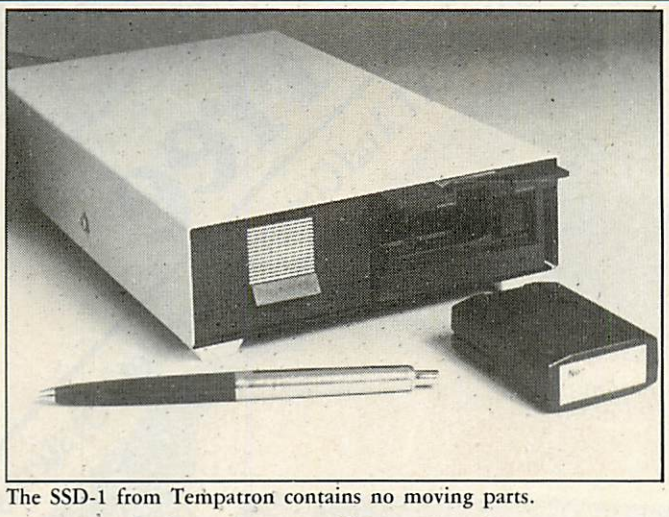
Apple '85 is the ideal opportunity to see all that's new in the Apple world of innovative technology – new hardware, new software and new directions. To exchange ideas, talk to the experts or get advice on all aspects of business and personal computing.

The latest members of the Apple family will be running the latest mouse-driven software. And the show will see the launch of Supercalc III, the extremely versatile spreadsheet, word processor and database package for the Apple IIe. The pioneering Macintosh will be seen for the first time displaying colour. Plus a wealth of new software now available for the machine that has revolutionised micro technology.

Visit Apple '85 and find out for yourself why more than 2 million Apple computers have been sold worldwide – and see the role they could play in the development of YOUR business.

● **Circle No. 111**



The SSD-1 from Tempatron contains no moving parts.

Solid-state floppies

A SOLID-STATE alternative to floppies has been developed by Tempatron, called the SSD-1. Based on the Fujitsu 1Mbit bubble memory, the unit contains two cassette holders, each of 125K, and emulation circuitry which allows direct connection to standard SASI disc interfaces. In this way the unit can be used in place of a conventional 5.25in. disc drive.

The two cassettes will function as two single-sided single-density discs, or one single-sided double-density drive. The main unit is physically similar to a stand-alone half-height disc drive.

Advantages of the solid-state system include no moving parts and greater resilience. The mean time between system failures is claimed to be 50 times better than floppies.

The main unit with two cassettes costs £960; additional cassettes cost £260 each. More from Tempatron on (0734) 596161.

Hunky Husky

THE HUSKY M-208 is a sturdy re-packaging of the already tough Husky Hunter, able to withstand extremes of vibration, shock and temperature. Its enhancements include backlighting of the 240-by 64-pixel display and screen-heating facilities for faster response in low ambient temperatures.

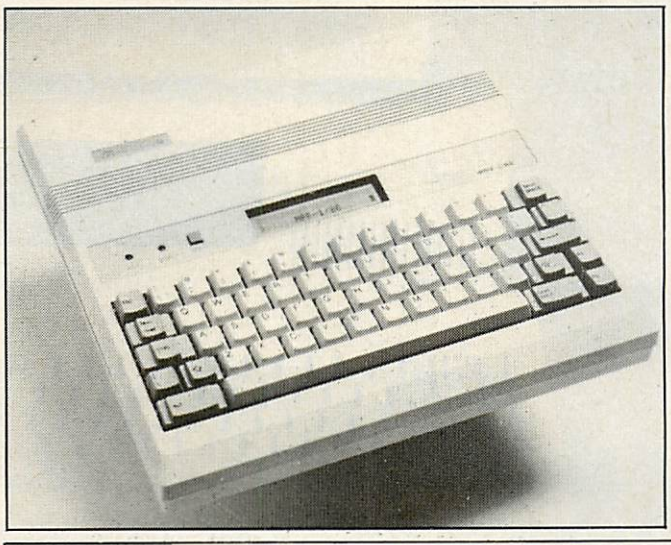
Designed primarily for military applications, it is also suitable for other hazardous environments. The cost is around £7,000. Details on (0203) 668181.

QL secrets

SINCLAIR has made available a 195-page technical guide giving details of the QL's hardware and software, including SuperBasic and QDOS. The *QL Technical Guide* costs £14.95 plus 95p post and packing, and can be obtained from Sinclair Research Limited, Stanhope Road, Camberley, Surrey GU15 3BR. Telephone: (0276) 685311.

QL Expansion Consul

SIMPLEX DATA has produced a two-slot expansion board for the QL. One slot is designed for use with Simplex's RAM expansion boards, which cost £99.90 for 64K, £198 for 256K and £396 for 512K. The second slot can be used for disc drives or other peripherals. The unit has its own power supply. The price is £49.50. Further details can be obtained from 01-575 7531.



8088 tutor

THE MPF 1/88 is a microprocessor teaching system built around the 8088. Similar in design to a lap portable, the unit costs £325 and comes with a moving-key keyboard, 20-character by two-line LCD, 4K RAM and 16K ROM. The RAM can be expanded to 24K, the ROM to 48K. There is an on-board disassembler and line assembler as standard.

The unit is designed to teach the fundamentals of the 8088 microprocessor. Later products will include a ROM-based Basic, and Forth software option. More from Flight Electronics Ltd on (0703) 34003. PC

HARDWARE SHORTS

- The PKASO/U universal printer interface allows you to hook up Apple II and Apple III machines to all parallel printers. It will also print spreadsheets sideways. The cost is £129. Details on (0706) 217744.
- Victor has reduced the price of its 10Mbyte Victor 9000 from about £4,000 to £3,295. Its 9000 2.4 machine now costs £2,495. More information on (0494) 450661.
- Solo is a Z-80 based micro from Kemitron designed with scientific and engineering applications in mind. The price is £990. More from (0244) 536123.
- Mannesmann Tally has cut the price of its 132-column, 160cps MT-180 printer by £100 to £649. Details on (0734) 788711.
- A disc-less Octopus has been released by LSI for use in networked systems. The dual eight- and 16-bit system costs £1,479. More on (04862) 23411.
- The ET Compact 60 from Olivetti is a portable electronic typewriter that doubles as a serial or parallel 10cps printer. The basic configuration costs around £400. Details from 01-785 6666.
- The MC-3810 is a precision data German data recorder that will work with a range of micros such as the BBC. Cost is about £26. More from 01-574 5271.
- Viewpac allows most micros to function as intelligent viewdata terminals, as well as accessing Prestel, Telex and PSS. The cost is £395. More information on (0635) 33009.
- The Jupiter Ace lives on. The Forth machine with a 16K RAM pack costs £35. More information from (0223) 61175.
- Sinclair is diversifying again, this time with a new company to produce the revolutionary wafer-scale integration memories.

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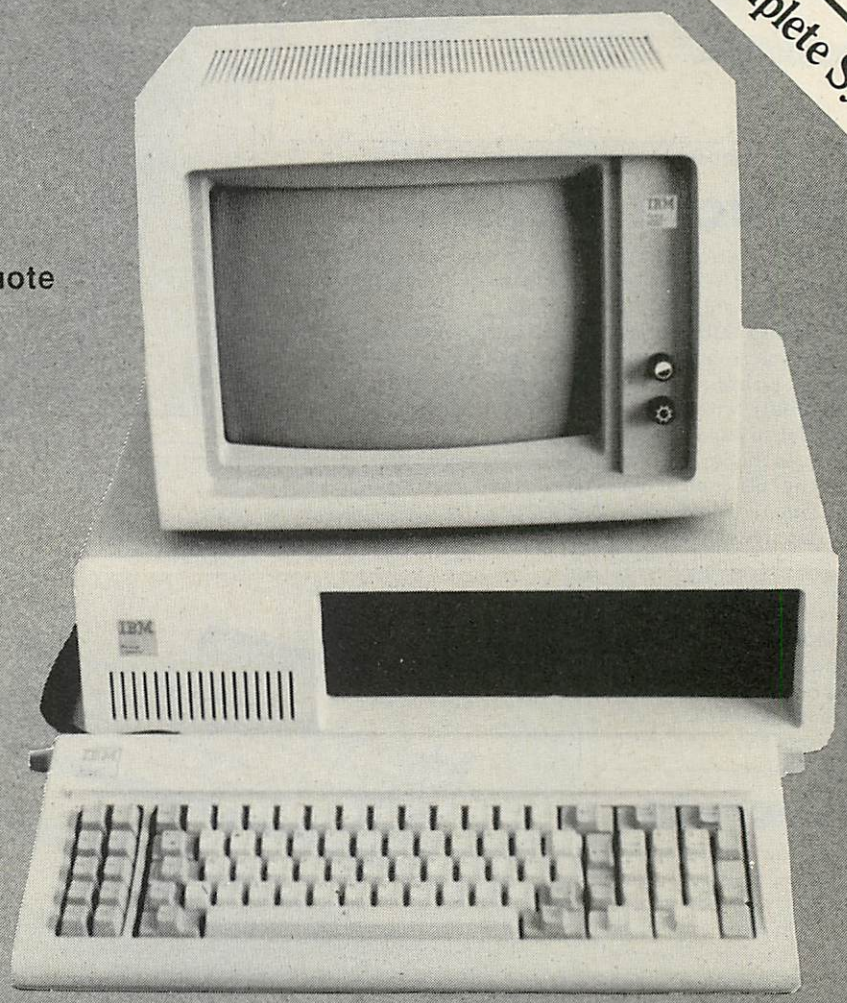

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WHO KILLED JR?

IN A SURPRISE MOVE, IBM has dropped the Junior. IBM launched a massive direct-mail campaign for its sawn-off PC at the end of 1984.

According to California-based research firm Infocorp, this brought it 17 percent of the U.S. market in December. That's more than the 11 percent held by the Apple IIe, or the Macintosh's 7 percent; all figures are for number of units. However, what might have alarmed IBM was that December sales of the PC itself fell from 10 percent to only 7 percent of the market.

Infocorp's January figures give the market as: Apple IIc 16, Apple IIe 13, IBM PC 13, IBM PCjr 11, Apple Macintosh 10, IBM PC/XT 6, IBM PC/AT 3. The other 31 percent went to lesser brands where the only interesting figures are Compaq's 7 percent and Commodore's 2 percent.

The IBM PC's recovery in January does not disguise the fact that, according to Infocorp, sales are well down on the 21 percent of a year earlier. Therefore to maintain and increase its market share, IBM must launch new machines to replace the discontinued Junior and the ageing PC.

Very shortly, then, we expect IBM to announce a new, smaller, faster version of the PC. It will use an 80186 chip and have 3.5in. disc drives. That is, in performance and appearance it will try to match the outstanding Nimbus micro from Oxford-based Research Machines Ltd.

Another strong tip is that IBM will launch a lap-top version of the machine. Don't call IBM, and no one will call you.

Infocorp is at 20833 Stevens Creek Blvd, Cupertino, Ca 95014-2107. Telephone: (U.S. area code 408) 973-1010.

Cheetah IBMulators

CHEETAH, best known for its home-computer peripherals, has now launched three U.K.-modified Far Eastern manufactured — our guess: Korea — 8088-based IBM PC compatible micros.

The Cheetah PC has 256K of RAM, two 360K disc drives and costs £2,595. The Cheetah XPC has one floppy disc plus a 10Mbyte or 20Mbyte hard disc and costs from £3,575. The Cheetah VIPC is the same as the XPC but also has a 20Mbyte tape backup; prices are from £5,465. This is close to the price of a Compaq Deskpro, but Cheetah says its machine is better.

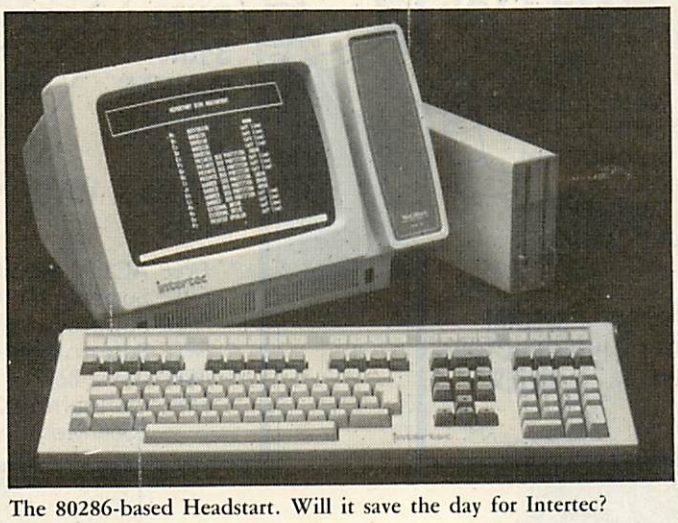
All the systems will be sold with bundled software — including a complete Colt Computers accounts package worth £650, plus Executive Writer, Number Works, and Executive Filer from Adam Osborne's American venture, Paperback Software. Also in the bundle are at least 21 programs available in the public domain. Cheetah is looking for dealers to take the systems.

Contact Cheetah, 24 Ray Street, London EC1R 3DJ. Telephone: 01-833 4909.

PC-Star

THE BROMCOM SUPERSTAR is a network-in-a-box. Each user gets their own CPU card, so there is not the degradation of performance you get with a shared-processor system. Bromcom claims it will soon be offering slave cards that are IBM PC compatible, to provide the would-be PC user with an effective multi-user system.

Contact Bromcom, 417-421 Bromley Road, Bromley, Kent BR1 4PJ. Telephone: 01-697 8933.



The 80286-based Headstart. Will it save the day for Intertec?

Intertec returns

ONCE UPON A TIME, an American company made a really ugly eight-bit CP/M crate called the Superbrain. Unlike many of its competitors, this machine worked — most of the time. It could be networked easily and it was very cheap.

Unfortunately, Intertec then did nothing for a long time, and when people stopped buying big, ugly eight-bit CP/M desk-top micros the company fell on hard times. It therefore decided to launch a machine called the Headstart, which was very small, very pretty, and included a 16-bit processor along with the eight-bit CP/M one. It was first shown in the U.K. at the Which Computer? Show in January 1984. By then no one wanted dual-processor micros, or anything else that wasn't IBM PC-compatible. And Intertec fell on even harder times. . . .

Then it got lucky. IBM announced the new AT model of the PC, creating a huge demand which it was not able to fill. Intertec having missed the 8086 market, was leapfrogging to the 80286 and found itself ideally placed to plug the gap.

Design a file server, convert the Headstart to a work station, and you got an IBM-compatible multi-user system that could form the heart of a 255-node network using Intertec's 3Mbit/second Multilan. But if you didn't want a multi-user system, just add twin-floppy drives and you had the ATS personal computer to rival the PC/AT.

Products and prices are: ATS-80286 work station with 256K RAM, $2,495; twin 5.25in. discs, $595; 25Mbyte Multilan storage system, $2,495; network card to add IBM PCs to the network, $695. In September, an 8086-based version of the ATS should be available for $1,995. It remains to be seen whether Intertec can win back its former Superbrain dealers and so get its products on to the U.K. market.

Contact Intertec, 2300 Broad River Road, Columbia, SC29210. Telephone: (U.S. area code 803) 798-9100.

IBM SHORTS

- DMA's Formula IV is claimed — probably incorrectly — to be the first multi-user database for the IBM PC and AT. However, it will allow three simultaneous users with file and record locking, plus it has an English-based query language. The U.K. distributor is Telesystems Ltd. Telelephone: (02406) 6365.
- Tallgrass Technologies has opened a U.K. office at Unit 6, Intec Two, Hassocks Wood, Wade Road, Basingstoke, Hampshire RG24 0PL. Tel: (0256) 460666.
- APL*Plus/PC is out in a new version, 4.1, and distribution has been taken over by Cocking and Drury of 16 Berkeley Street, London W1X 5AE. Telephone: 01-493 6172.
- Printworks is a utility that offers control of over 30 different dot-matrix printers. It includes a fount editor and sideways printing. Phone Pete & Pam on (0902) 43913.
- PC to Mac and Back, the Apple/IBM communications package described in our January issue, is now available from Holt Saunders, 1 St. Anne's Road, Eastbourne, East Sussex. Telephone: (0323) 638221.
- IBM U.K. is to sell two Compsoft packages: Domino, the new training and assessment program announced last month, and Delta 4, the well-established database. Every IBM PC dealer should have copies available.

Kaypro's AT clone

THE KAYPRO 286i, announced in California, is a desk-top micro, not a transportable. It features an Intel 80286 CPU running at 6MHz, 512K of RAM, colour graphics and two 1.2Mbyte floppy-disc drives. The new system is claimed to be compatible with the IBM PC/AT, and costs $4,550 without monitor — $500 more than a comparable AT system with only 256K of RAM and one disc drive.

Contact Kaypro (U.K.) Ltd, Elm House, Elmshott Lane, Cippenham, Berkshire. Telephone: (06286) 67344. PC

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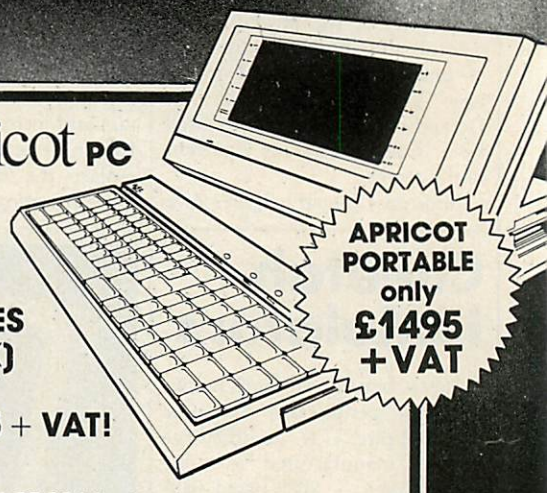

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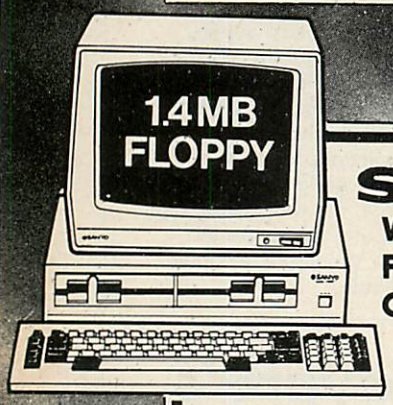

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Another new release is the highly successful JUKI 6000. There aren't many letter quality daisywheel printers designed specifically for use at home.
The high speed JUKI 5520 dot matrix printer is a stunning example of high quality advanced technology at a remarkably low price. Complete with graphic mode, it's ideal for your personal computer, and even has an optional 4-colour print function.

See them all for yourself at your local JUKI dealer.

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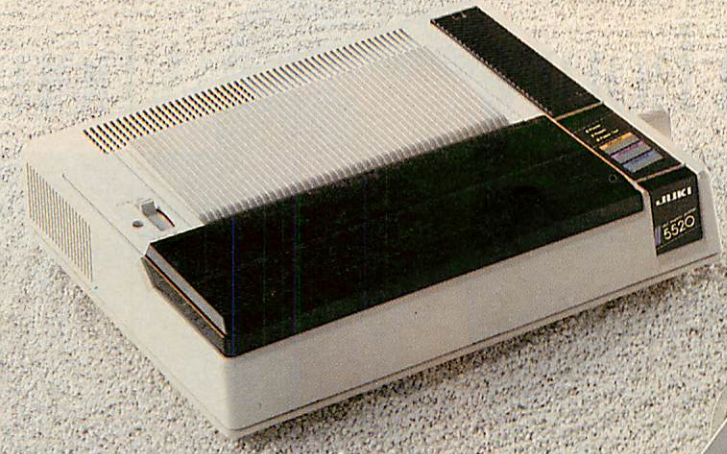

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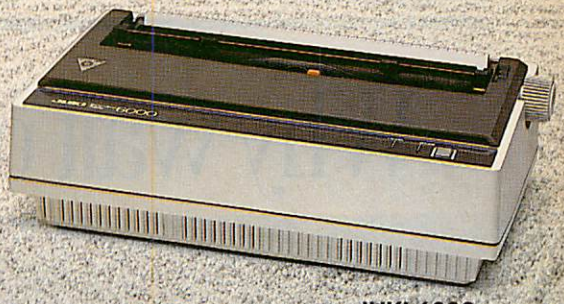
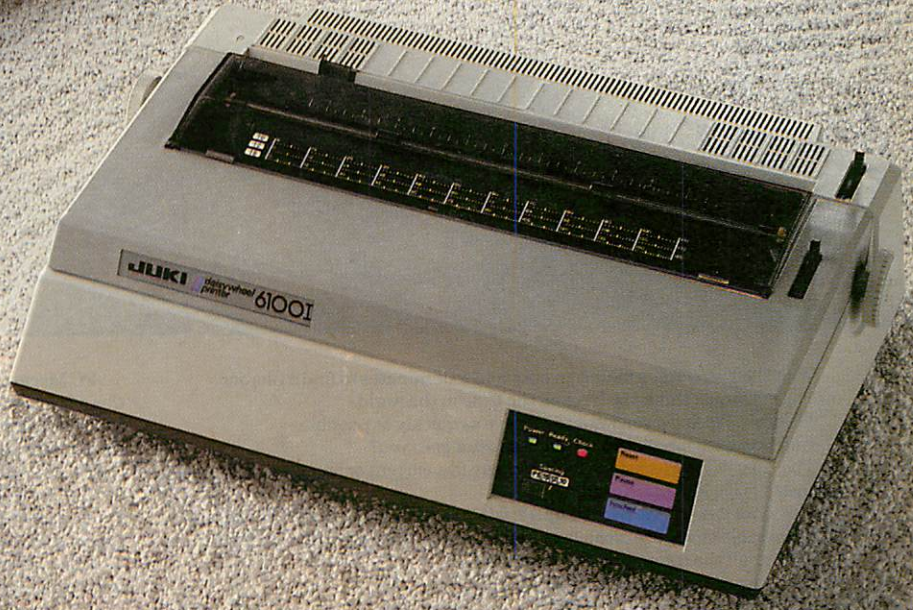


JUKI 6000



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Trigger the watchdog prog

TRIGGER is a business program which will monitor virtually anything you can count. It costs £453 and runs on the IBM PC.

The idea of Trigger is to help you keep track of key areas of your business — sales, costs, customer complaints, that sort of thing — and to spot unplanned-for situations as they develop. To use Trigger you first create a spreadsheet-like model, defining at the same time trigger points for key variables. In subsequent time periods, as you enter data, Trigger will issue various reports and charts if your key variables fall outside your pre-defined limits.

You can also get Trigger to ask you to enter an explanation when it reports an off-plan event. Over time Trigger builds up a database of the things you are monitoring, along with the reasons given for off-plans events, thus helping you track down recurring problems.

Contact Thorn EMI or Softsel. Telephone: 01-844 2040.

OPTIONS

OPTIONS is a new package which takes the spreadsheet concept one step further by working out the probability of a particular What-If? result. You start by entering data into a conventional spreadsheet screen; alternatively you can copy it in from existing Multiplan, Supercalc or Lotus 1-2-3 files.

But unlike a conventional spreadsheet, Options allows you to enter a range of likely values in place of any figure or formula. For instance, you could allow all your projected sales figures to vary plus or minus 10 percent, let materials costs vary 7 percent and the bank interest rate 2.5 percent.

Options then works out a large number of different results, attaching a probability to each one based on the information you have given it. Options cost £145 and is presently available for the IBM PC, with Apricot and Sanyo 555 versions imminent.

Contact Softsel, telephone 01-844 2040, for dealers, or for more details contact Sagesoft Ltd, NEI House, Regent Centre, Newcastle Upon Tyne NE3 3SB. Telephone: 091-284 7077.

C for QL

GST has announced the first C compiler for the QL. Called QC, the GST implementation is not quite a full version of the systems-programming language as defined by Kernighan and Ritchie. It supports pointers and arrays of pointers, but not multi-dimensioned arrays, unions, structures or Typedef.

QC does include a 68000 assembler and linker, and it costs £59.95, supplied on a standard QL Microdrive cartridge. Contact GST Computer Systems Ltd, The Green, Willingham, Cambridge CB4 5JA. Telephone: (0954) 81991.

Amstrad Calc and chart

MASTERCALC is a new spreadsheet program for the Amstrad CPC-464 which allows especially large models — up to 3,000 cells according to Amsoft. You can display windows into two different parts of the spreadsheet at the same time, and dump to an Epson-compatible or Amstrad printer. Mastercalc costs £19.95 including VAT on tape or £24.95 on disc, where it runs under Amsdos.

Micrograph is a bar, pie and line chart drawing package which interfaces to Microspread, Amsoft's fuller-featured but fewer-celled spreadsheet which runs under CP/M. Micrograph will print charts from Microspread data, but not from Mastercalc or other spreadsheets.

You can control the display colours used, and Micrograph allows you to set up sequences of charts to display in an automatic or cued slide show. Micrograph will be launched in mid-April, priced probably at £24.95.

For more details contact Amsoft, Brentwood House, 169 Kings Road, Brentwood, Essex CM14 4EF. Telephone: (0277) 230222.

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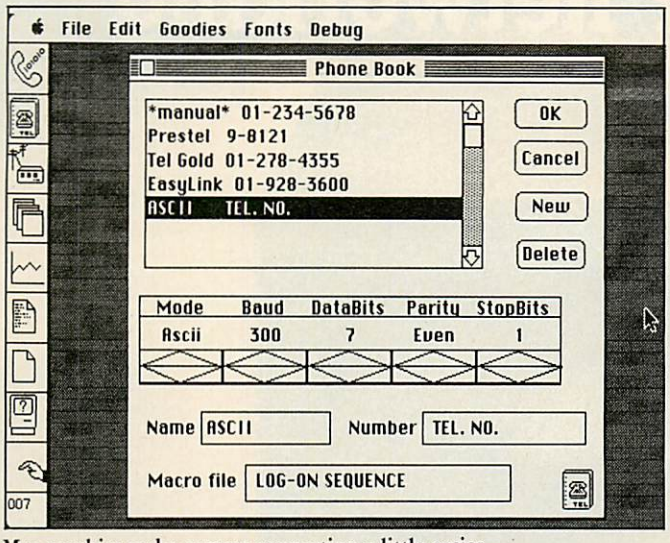
™PC Megastore is a trademark of Ampex Corporation. *IBM-PC and IBM-XT are trademarks of IBM. †Apple



Mac graphics make comms connection a little easier.

Mac Prestel

VICOM allows Mac users to communicate down the phone with both ASCII text systems like Telecom Gold or bulletin boards, or with frame-based viewdata systems like Prestel. Costing £150 plus VAT, Vicom uses the Mac's visual interface as much as possible to make connection easy, and it is compatible with a wide range of modems.

Since the Mac has a monochrome screen, and most viewdata frames are in colour, Vicom lets you associate different Mac founts with coloured text and assigns grey scales to colour graphics.

Contact P&P, Probe and Softsel dealers, or for more details contact AM Computer Technology Ltd, 19 Kensington Mews, London W8 5DR. PC

SOFTWARE SHORTS

● Lotus Developments' heavily hyped do-everything package for the Macintosh, Jazz, is late. The official release date has slipped from April to May 27. Telephone: (0753) 840281.

● Better news from Lotus is an Apricot version of Symphony, which is the equivalent package to Jazz for IBM-style computers. It combines spreadsheet, graphics, database, WP and comms. The Apricot version of Symphony supports ACT's modem card and is already out with dealers. The price is £595 plus VAT. Contact Lotus Developments U.K. Ltd. Telephone: (0753) 840281.

● TK!Solver College Edition is a dramatically cheaper version of TK!Solver for universities and colleges. It runs on the Apple IIe and IBM PC, and normally costs well over £300. It is designed to solve equations, both linear and non-linear, for multiple unknown variables. it will also convert units automatically and produce plots and tables of the results. The educational price is £59 direct from Software Arts International, 43 Buttermarket, Ipswich, Suffolk. Telephone: (0473) 221551.

● C-64 Forth Plus is a Forth language compiler for the Commodore 64 which supports the machine's sprite, sound and colour-graphics features. C-64 Forth Plus, which costs £14.95 including VAT, also includes the standard set of Forth commands laid down in the old Forth Interest Group definition of the language. Contact Melbourne House. Telephone: 01-940 6064.

● Estimator is designed to work out professional quotations and print them in a format stipulated by the user. The system costs £295 and runs on the IBM PC and other 16-bit systems under MS-DOS and CP/M-86. Details from Xitan Ltd, 27 Salisbury Road, Totton, Southampton SO4 3HX. Telephone: (0703) 871211.

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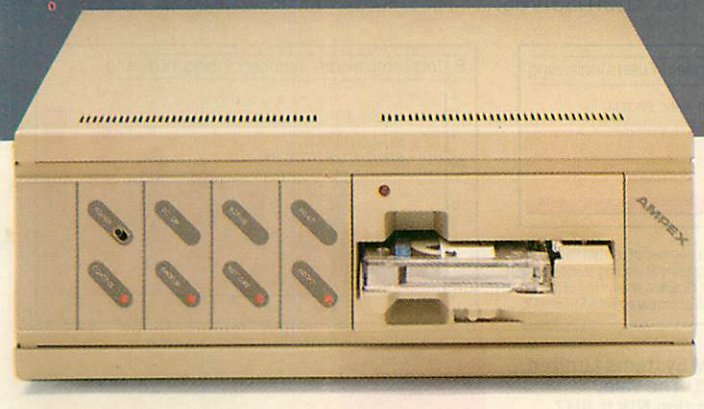

And if all that doesn't impress you, how about this. With its one year warranty every PC Megastore has Ampex's 20 years peripherals design and manufacturing expertise built into it.

If a minute and a half sounds better than an hour and a bit, you'd better look at the PC Megastore.

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It's not easy to build an effective multi-user system.

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Make no mistake, any multi user system is only as good as its operating system. Minstrel 2 uses TurboDOS® We've not come across a more flexible and powerful tool.

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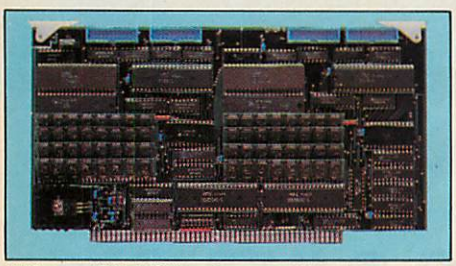
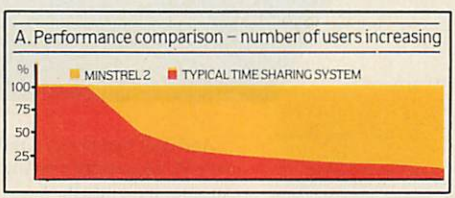
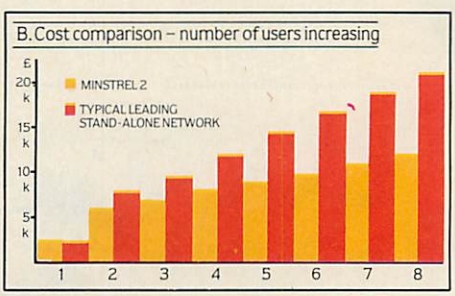


HM Systems HTS 86, 16 bit performance at 8 bit prices.



Costs rise and performance suffers when a number of terminals share a common processor. Graph B shows a network of leading stand-alone computers when compared with Minstrel 2. Graph A shows the effect on performance of timesharing compared with Minstrel 2.



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PRISM SCATTERED

OPUS SUPPLIES has bought Wren, the British micro manufacturer that was part of the Prism Micro Products, now in receivership. Opus is best known for selling disc drives for the Acorn BBC B, and it has recently launched a disc system for the Sinclair Spectrum. The Wren is an eight-bit CP/M semi-transportable costing about £1,000. It was reviewed in *Practical Computing's* June 1984 issue.

Modem House has acquired the communications products previously sold by Prism. The main one is the Prism VTX-5000 1,200/75 Prestel-type modem for the Sinclair Spectrum, which should shortly be available for under £50. There is also said to be hardware, software and cables available for other machines including the IBM PC, Apple, ACT Apricot, BBC, Commodore and Dragon.

It seems unlikely that the receiver will now be able to sell any other parts of the Prism empire.

Contact Opus Supplies, 158 Camberwell Road, London SE5 0EE. Telephone: 01-701 8668. Modem House, Iolanthe Drive, Exeter, Devon EX4 9EA.

The Hacker's Handbook

THIS SLIM but entertaining book contains a useful summary of communications techniques, plus stories about Famous Hacks. It does not, however, provide information that would enable any half-baked twit to break into the computer at the local bank or even MI5. This will disappoint many readers who have read lurid reports in the national press and some of the computer comics.

As the author points out, it is far easier to commit fraud and theft by conventional means, including bribery and blackmail. However, if the book jolts people out of their lackadaisical attitude to passwords and security it should have a beneficial effect.

The Hacker's Handbook by Hugo Cornwall is published by Century Communications at £4.95. ISBN 0 7126 0650 5.

Enhanced Robocom

ROBOCOM has launched the Robo 1500E low-cost Technical Drafting System. It is based on the Apple IIe and has several new features, including automatic dimensioning, adjustable curve routines and eight built-in hatch styles. The system is suitable for civil and mechanical engineering work, panelwork, packaging, architecture and building.

Robocom entered the field three years ago with the Bitstik Graphics system, reviewed in *Practical Computing's* November 1982 issue. The product line continues with the Robo 1000 Technical Graphics System, and is now completed by the 1500E Technical Drafting System.

Contact Robocom Ltd, Clifton House, Clifton Terrace, London N4 3TB. Telephone: 01-263 8585.

Communications

APPLE OWNERS now have their own user group on Telecom Gold. For no obvious reason the group is called The Force. It has been organised by Basug, the British Apple Systems User Group, and will use numbers BSG001 to BSG250. Phone Richard Boyd on (0223) 860767. His Gold number is TCC088, but who knows on which of the six systems that is?

NEC has now come into line with Olivetti and Tandy by offering Telecom Gold electronic mail with its cheap Kyocera lap-held, the NEC-8201a. This £299 micro can also be used to send and receive telexes via Gold. Phone NEC on 01-267 7000.

A Japanese shopping service has been launched on Prestel. It has been organised by Fuji bank and Matsuzakaya. Items can be selected from an on-screen catalogue and paid for by credit card. The service is aimed mainly at Japanese living in the U.K., but British customers are welcome to join in. Contact Matsuzakaya, Central Merchandising Office Telecommunications Media Development Room, 10-1, Ginza 6, Chuo-ku, Tokyo. Alternatively check Prestel page *298# and use mail-box number 118100002.

British Telecom is installing a new high-speed access network bought from Telematics International. It will provide 60 nodes throughout the U.K., offering more people local-call access to services such as Telecom Gold and Prestel. Also it is claimed it will provide a faster response. The access link will support 1,200/75 baud plus 300 baud, 1,200 baud and 2,400 baud communications.

Mung

FOLLOWING the success of Mud, the Multi-user dungeon, Infomania is launching Mung, a multi-user network game. The specification includes 2Mbyte of main memory, 40Mbyte of hard disc and over 10,000 map locations.

Mung can cater for 1,000 system characters, with up to 50 people playing at once using 1,200/75 Prestel-type modems. The first scenario is expected to take about a year, and the membership will be limited to 1,000.

Contact Mung Applications, Infomania, Carey Place, Watford, Hertfordshire WD1 2LR. PC

IN BRIEF

Wordwise users can now obtain a Wordwise Applications Guide from T E R Roberts, Lamorna, The Street, Bunwell, Norfolk NR16 1NA for £7, including post and packing. This useful book has been writtten by Paul Beverley and is published by Norwich Computer Service.

Microcomputer Alert is a monthly index of microcomputer magazines including *Practical Computing, Personal Computer World, Byte* and many more. The cumulated 1984 edition is now available for £14 from John F Convey, 38 Part Street, Southport, Merseyside PR8 1HY.

The Data Protection Registrar, Eric Howe, has now moved to his permanent office at Springfield House, Water Lane, Wilmslow, Cheshire SK9 5AX. Phone: 061-273 6607.

Missile Command, the old track-ball operated arcade game, can now be played with a mouse on the Apple Macintosh in a new version called Ground Zero. It costs £36.15 including VAT. Phone Softsel on 01-844 2040.

Executive Suite is not a new multi-function package, but a game for the IBM PC. This "Gray Flannel Fun" game is based on office politics and costs £25.95 plus VAT from Pete & Pam. Phone (0706) 217744.

Retail Software Forum is a new exhibition to be held at the Novotel, Hammersmith on May 15-17. The aim is to help retailers choose suitable computer software. Phone RMDP on Brighton (0273) 722687.

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- **SUPERB MANUALS:** operating level to full technical spec (US written).
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- **PRICE:** unbelievable for the quality of this product from the mini-computer division of NEC (world's 3rd largest micro manufacturer).

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Casting their networks

Why do you think Omninet has done so well in the local area network market?

From its initial introduction, Omninet was geared to the personal computer. The other networks that were available at the time, such as Ethernet, were considerably more expensive. Today they are still considerably more expensive than Omninet is. We wanted to offer the performance that a personal computer user needed at a price he could afford. The price relationship between network node and computer should be around 1 to 3, and this is where we positioned Omninet.

When we came to market we were one of the first players in networks, particularly for personal computers, and a lot of software has been developed that is Omninet specific. We were able to grow our base from that software and from that initial price performance. Now we offer a link-up to SNA; for the business user, the ability to link up to IBM is very important and we have some significant customers worldwide that are using the SNA gateway.

How do you expect the LAN market to develop in the future?

I think that the LAN market is still embryonic today. Although we hold more than half the installed number of nodes in the market, the installed number of nodes in the world is not all that great at 300,000. With the giants IBM and ATT coming to market, we'll see more interesting LANs. Some people will buy a LAN just because IBM is offering it.

We'll also see a lot of software developed for LANs and, as we all know, software sells hardware. You are able to solve problems instead of just having a piece of technology in your office. With that software and with IBM's push behind it we'll see the market expand. I'd expect it to go from the 300,000 nodes that we see today to two million nodes in 1986.

What impact do you think the increasing use of LANs will have on the way we use micros and computers?

One thing that they do is to make things more cost effective, for example by sharing peripherals. You can share a printer — you don't need a printer on every computer. You can share a disc drive — a Winchester and a backup to a Winchester can all be shared amongst eight computers or 10 computers or up to 64 computers. It provides a communications link to the mainframe, with such things as the SNA gateway product. You can have a common database: everybody can be sharing it and upgrading it at the same time, so it improves the quality of information as well as the price performance for the peripherals.

MICHAEL D'ADDIO, President and Chief Executive Officer of Corvus Systems — interviewed by Glyn Moody.

Michael D'Addio set up Corvus Systems in August 1979, originally to manufacture 8in. Winchester discs for use with Apple computers. In 1980 Corvus entered the local area network market with its Multiplexer system for micros. Omninet was introduced in 1981. Today over half of the installed LAN nodes in the world use Omninet. In 1982 the company launched its first micro, the Corvus Concept. It was designed primarily as a LAN work station, and was reviewed in the September 1983 issue of *PC*.

For the financial year ending 31 May 1984, Corvus reported net sales of $50 million and a net loss of over $10 million. This compared with sales of $47 million and profits of $4 million the previous year. For 1985, sales are expected to top $60 million, with a return to profitability.

Earlier this year, Corvus announced that Roy Wright will join as Chief Operating Officer. Wright held a similar post at Victor Technologies, where he succeeded in turning the company's finances around and in paying off many of its debts.

Corvus products were distributed in the U.K. by Keen Computers Ltd, until that firm went into receivership on 21 November last year. Since 21 January the distributors of Corvus have been Vistec Business Systems Ltd, part of the Electronic Rental Group. Vistec is on (077382) 6811.

How do you see Omninet fitting into that future marketplace?

Omninet will continue to offer the best value in LANs: that is our intention and we think that our technology will allow us to do that. We have certain market niches we're very strong in, such as the educational market in the U.S. where price is very meaningful.

On the business side, I think we will fit in as the departmental network. We are firm believers in hierarchical networking at Corvus; we feel that you will have departmental networks with low-cost connectivity with lots of services. Then you will have a backbone net which may be true broadband or fibre optics that will take you through the core of the building or around a campus, which will have higher cost per connectivity. Our positioning will be at the departmental level, with very cost-effective networking. Ultimately we think that Omninet will be integrated into the PBX arena and will provide low cost per connectivity there also.

What new products do you intend releasing?

Two products available from this quarter are the Macintosh network and the interface for Appletalk. We feel that the Mac will do quite well in the university environment, and hopefully in the business marketplace. We will provide high-quality peripherals and LANs for the Mac line: file servers, printer servers, backup devices. Another product is the interface to MS Networks, the IBM PC network.

We wish to be software compatible with IBM's network and thus to offer the end-user choice as to the price performance for the IBM. We will be offering a network for roughly half the cost of the IBM version. We have an add-in drive for the IBM PC which allows a low-cost upgrade to the XT level — 10 megabytes for about £1,000.

The other new product is the four megabit per second implementation of Omninet, the VLSI implementation; that won't be out until 1986. We're jointly doing that with NEC. It will allow better price performance for the end-user. At four megabits per second Omninet should outperform every major network on the market today. Even though Ethernet is 10 megabits per second, if you look at the studies that were done of the LANs, Omninet is considerably more efficient than Ethernet and we expect that with the four times increase in speed that we'll see a considerable performance differential.

Can you clarify the situation as regards Keen computers?

Vistec is our distributor now in the U.K. They have taken over since Keen went into receivership. Vistec is the third largest IBM retailer in the nation. They are a subsidiary of Electronic Rental Group which has a turnover of about £244 million. Vistec represents about £25 million of this.

Vistec is a strong company financially, and a very seasoned company. They will offer everything from an installation capability to an on-site servicing capability, with good sales and support staff. We're very excited about the new relationship. PC

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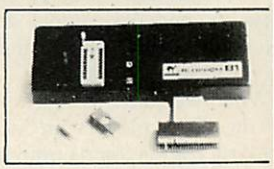
STATUS
NO. OF SYSTEM —HEX
EPROM TYPE —27128
RAM START ADDR —4000
EPROM ST. ADDR —0000
JOB LENGTH — 4000
TASK — CHECK
WHICH TASK DO YOU WISH TO DO
W) CHECK THAT EPROM IS CLEAN
X) READ THE CONTENTS OF EPROM INTO RAM
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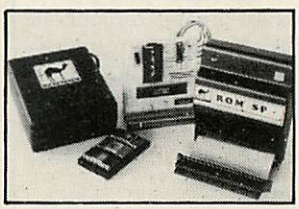

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The Chit·Chat Communications Pack at only £399+ VAT, includes the Chit·Chat program, a state-of-the-art modem, specially made to Sagesoft specifications by Thorn-EMI Datatech. No knobs or switches, just sleek good looks and simple, error-free operation. Autodial and autoanswer facilities are incorporated and the unit is entirely software controlled. An RS232 cable and power pack are included in the package.

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ASK PC

Q I have been developing an accounts program in Basic called PAY.BAS and have stored it on disc. On the directory listing the file appears twice, once as PAY.BAS and once as pay.BAS. From the amount of space occupied as shown by Stat it would seem that there really are two copies of the accounts program. I tried to delete pay.BAS using the Era command but succeeded in deleting PAY.BAS. Is there any way of making this file accessible again? If not, is there any way of deleting it?

N Brown

A CP/M file names can be made up from any of the characters in the ASCII set except < > , . : = * ? [ ] which all have special meanings. However, in file names it is usual practice to avoid using lower-case letters. The CP/M console command processor automatically converts all lower-case letters that you type in into upper case, and hence any files created by the CCP contain upper-case letters only.

One notable exception to this rule is Microsoft Basic, which does not convert lower-case letters into upper case when they appear inside quoted strings. To store a program on disc from Microsoft Basic you type a command like

```
SAVE "PAY"
```

If instead you type the command using lower-case letters this gets converted into

```
SAVE "pay"
```

Since you have not specified the file type MBasic automatically adds an extension of BAS and the program is stored on disc with the lower-case name pay.BAS rather than PAY.BAS. If you had previously saved the file correctly you would then have two copies of the program on disc — one called pay. BAS and the other called PAY.BAS.

There is nothing you can do at CP/M command level that will access the file with lower-case letters in the file name, because CP/M converts lower-case letters into upper case. So when you typed

```
ERA pay.BAS
```

this was converted into

```
ERA PAY.BAS
```

and that is why you deleted the wrong file.

The only way you can delete the file from CP/M is to type

```
ERA *.BAS
```

which will delete all files with extension .BAS.

The best approach is to get back into Basic, load the file and resave it properly, then delete the problem file. This can be done by:

```
MBASIC
LOAD "pay"
SAVE "PAY"
KILL "pay.BAS"
```

Q I would like to know if there are any cross-compilers or assemblers for business machines such as the Apricot, Advance or CP/M to develop software for the popular home computers?

P J Newcombe

A The simplest solution is to write your programs in a language that will be understood by both your development computer and the target machine. If you want to write in Basic, then you should either write in an elementary subset of the language, or possibly use the Z-80 version of the popular BBC Basic to write programs for the 6502. Pascal is claimed to be more portable.

However, code written in C is highly transportable. The set of CManx C compilers and cross-compilers claim to produce machine code for CP/M-80, CP/M-86, PC-DOS, Apple, Tandy, Commodore 64 or Macintosh when running on any CP/M, PC-DOS, Apple, Vax or Macintosh computer. These C compilers cost $200 to $250, in the U.S., and the cross-compilers cost a staggering $750. CManx products are marketed in the U.K. through Tamsys Ltd of Windsor, Berkshire. Telephone: (0753) 56747.

Another alternative widely adopted in the universities is to use a minicomputer or mainframe to simulate the microprocessor that you want to write code for. You can then use the university computer to develop and debug the software.

A lesser version of the Microsim philosophy is a cross-assembler. This allows you to program in machine-code mnemonics for the target computer while running on a different machine. Avocet Systems Inc. offers software which runs under CP/M-80, CP/M-86, PC-DOS and MS-DOS and allows code to be written for the following microprocessors: 6804, 6805, 6809, 1802/1805, 8048/8041, 8051, 6502, 6800/01, 6301, NEC 7500, 8085, COP-400, F8/3870, Z-8, Z-80, 68200, 68000/68010.

The cost depends on which combination you require but is typically $200 to $250, except for the 68000 versions which cost $595. All versions include a full-screen editor. Avocet can be contacted at Dept. 1284-B, 804 South State Street, Dover, Delaware 19901, U.S.A.

Another company selling cross-assemblers is 2500AD Software Inc., PO Box 4957, Englewood, Co 80155 U.S.A. They allow software for the 8080, 8086/8088, 68000, 6502, 6800 family, 16000 family, Z-8, Z-80, Z-8000 processors to be developed under Z-80 CP/M, MS-DOS, CP/M-86, Zilog System 8000, Unix and Olivetti M-20 PCOS. Prices are mostly $100 for eight-bit or $200 for 16-bit systems; the Unix versions range from $500 to $750. PC

Serial to parallel

Q I have a Brother EP-44 typewriter with an RS-232 interface, and a Ricoh 1500 daisywheel printer with a parallel input port. I would like to connect the two devices, and require a serial-to-parallel converter. Could you please either let me have a circuit that will perform this task, or let me know where I could get a proprietary converter?

Michael J Forde

A This is not a new problem, since printers with parallel ports are usually cheaper than those with serial ports. At its simplest, a serial-to-parallel port could be a Uart to receive the serial information, and some switches to set the baud rate of the Uart. Plainly the electronics will require a power supply, usually 5 volts, and this may be obtained either from the computer or from the printer, or provided by a built-in supply powered from the mains.

We know of two commercially available serial-to-parallel converters. The first is the S1 unit from Aculab Ltd, Leighton Buzzard. Telephone: (0525) 371393. This draws power from your existing devices, and costs £66 plus VAT. The second is from Micro General of Reading, Berkshire and costs £75 plus VAT. Telephone: (0734) 25226. This has a power supply included.

An alternative approach is to use a printer buffer. They are usually used to connect computers to slow printers come in a variety of sizes from 8K upwards, and with serial or parallel input and serial or parallel output. A cheap 8K buffer is available for £85 plus VAT from AMA Computer Supplies, Dept B, 8 Glebe St, Beeston, Nottingham NG9 1BZ.

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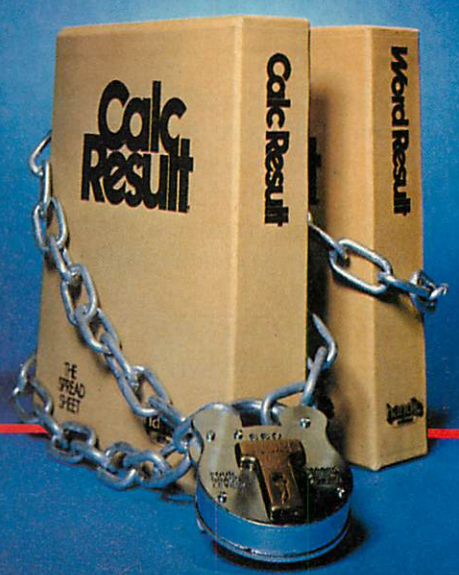

by Ray Coles

The imitation game

THERE WAS A TIME when the naughty Japanese inclination to copy all things Western was regarded with little more than indulgent amusement in the West. Cheap Japanese watches were a music-hall joke, and in most cases it was easy for purchasers to indentify the crude oriental imitations and to select the high-quality British or American product instead.

Alas, those days are long gone, and Japanese technology whether it be in cameras, watches, cars or video recorders is now regarded as being synonymous with the very highest quality. When discrimination does occur, it usually operates in favour of the Japanese product. In some cases Japanese products have been so plentiful and successful that they have all but eliminated the Western competition. When did you last see a British camera, or a British motorcycle?

Straight copies

In the semiconductor industry Japanese infiltration has followed the same predictable course. At first, direct copies of mature Western devices appeared with the same or similar part numbers. At that stage the technology employed was not state-of-the-art, so the copying was not considered to be too serious and it continued unmolested.

Next, the Japanese chip manufacturers concentrated on building a reputation for high quality and high-volume availability, factors which ultimately won them the approval even of American equipment manufacturers. Hewlett-Packard has in the past stated its preference for Japanese RAM chips — to the horror of American chip manufacturers.

Even at that stage the complacent Western semiconductor industry was still able to congratulate itself on always being first with new technology, and to write the whole thing off as a rather sneaky oriental trick. Copying was hardly cricket, it was reasoned, but there wasn't a lot to worry about because the Japanese just didn't have the same natural creative ability as their Western counterparts and that would mean they would always be one step behind.

We are now in the tertiary stage of the Japanese game plan. Instead of sending boat loads of high-quality, low-cost copies of Western microprocessors and memory chips, the major Japanese chip manufacturers are now sending boat loads of high-quality, low-cost much improved versions of those chips. The world's equipment manufacturers are starting to rethink their traditional dependency on Western leadership as a result.

In many Western eyes this is still copying, both morally and in law. Intel has recently filed a suit against the Japanese NEC corporation alleging that the NEC V-20 and V-30 microprocessors infringe Intel microcode copyright on the 8088 and 8086 designs. More significant to the outside observer is the fact that the V-20 and V-30 designs are significantly improved over the Intel devices. If the Japanese can now begin to introduce their improved versions immediately after the Western originals appear they will mop up an increasing share of the profits to be made in the chip markets.

Hitachi's new eight-bit processor chip executes the Z-80 instruction set — but that's only the start.

Certainly one can't help but be impressed by the increased capabilities of some of the new Japanese chips. Take the Hitachi HD-64180, for example: an eight-bit microprocessor able to execute the complete instruction set of the ever-popular Zilog Z-80, but with so many advanced features that the package pins must positively groan under the strain.

The HD-64180 can hardly be called a copy of the Z-80, since every square micron of the chip surface is new. The astute strategy of making this advanced device compatible with all existing Z-80 software and peripherals is quite in keeping with the traditional Japanese aversion to innovation for its own sake. Indeed, the differences outweigh any similarities to the Z-80 by a wide margin, and yet the chip retains absolute compatibility with the essential features of Z-80 hardware and software system design, so that existing users can easily step up if they wish.

The CPU has been designed in a microcoded form, rather than in the messy random-logic form of the Zilog chip, and low-power CMOS technology replaces the Z-80's power-hungry NMOS. Basic performance has been greatly improved by virtue of a clock speed of 6MHz and a new pipelined architecture which, together with the microcoded CPU, has reduced the number of basic clock cycles required for many standard Z-80 instructions.

New instructions

To overcome an often-heard criticism of eight-bit processors, the HD-64180 can address 512K of memory via an on-chip memory-management unit or MMU rather than the 64K of most other eight-bit devices. The HD-64180 has 12 new instructions, including the power-saving SLP to enter Sleep mode, an eight- by eight-bit multiply, two new sets of block I/O and non-destructive test instructions, and two new immediate addressed register I/O instructions.

To keep system size and cost to a minimum, nearly all the circuitry normally provided by separate peripheral chips has been integrated on to the HD-64180 itself. An on-chip MMU, for example, maps the 64K logical memory space into a healthy 512K of physical memory address range. To do so it uses a straightforward bank-switching technique for compatibility with existing Z-80 code.

For serial communications, two separate on-chip asynchronous serial communication interface or ASCI channels, complete with a programmable baud-rate generator, are provided to link the CPU to terminals, printers, and the like. For occasions when the speed of asynchronous serial transfer is too slow, as may be the case in local area networks or a tight-coupled multi-processor system, an on-chip clocked serial port capable of transfers at up to 300Kbit per second is provided in addition to the two ASCIs.

Direct memory access

An on-chip interrupt controller is included to monitor and prioritise the four external and eight internal interrupt sources using a variety of progammable interrupt response modes. A two-channel direct memory acess controller, DMAC, is available to reduce processor overhead during memory-to-memory and memory-to-I/O transfers. The DMAC can directly address the 512K physical memory space to control transfers of data blocks of up to 64K, even when they cross block boundaries.

Two programmable reload timers, PRTs, are available, each consisting of a 16-bit pre-settable reload register and a 16-bit count register. One PRT channel can provide an external output for waveform generation. Unlike the standard Z-80, it includes an on-chip 6MHz clock generator, together with pre-scalers to drive the other on-chip facilities like the ASCIs and the PRTs.

Even the bus interface has been souped up to permit easier interfacing to large memory arrays and the widest possible range of external peripheral cricuits. Dynamic RAM refresh suitable for the latest 256K chips is built-in, as is compatibility with both Z-80 and Motorola-style peripherals.

In many applications this new Hitachi chip will rival the performance of 16-bit processors such as the 8088, and its low-power CMOS operation and high level of integration make it ideal for compact battery-powered lap computers.

Zilog has its own plans for a similar device, coded the Z-800. It was announced several years ago but is still unavailable in any quantity. Watch out Zilog, and remember those British bikes. PC

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by Ben Knox

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The Source was launched at the Comdex computer trade show in June 1979, and within a short time had enrolled 8,000 subscribers. Initially the service piggybacked on the Prime minicomputers of the Dialcom electronic mail service in Silver Spring, Maryland. Britain's Telecom Gold is a licensed version of ITT Dialcom and also runs on Prime minis, and this accounts for many resemblances between the two systems. However, The Source provides a great deal more than electronic mail, as the printout of the main menu here shows.

LAST MONTH I took a look at Compuserve, America's most popular videotex service. Its main competitor over there is The Source.

The Source went public in 1979. Since then it has attracted a user base of about 60,000, compared to Compuserve's 160,000. There are areas for the casual or home user, but the system is biased towards the business end of the information market.

Users from the United Kingdom use British Telecom's Packet Switch Stream to access The Source: the address is A9311030100162. Once connected you are requested to enter your ID and password. You do this by typing ID followed by a space, followed by the User's ID number, then another space, and finally the password. Users of Telecom Gold, British Telecom's own electronic mail system, will be familiar with this format, as The Source runs on the same Prime minicomputers.

Having gained access you are presented with the main menu. From here you are routed to one of the main sections, which include: News, Business, Travel, Communications, Personal Computing, "Today", and so on.

Under News you will find databases owned by most of the major news organisations, including Associated Press and United Press International. As well as getting up-to-the-minute news, you can initiate searches throughout the whole news database.

News bulletins

You can go into Newswire mode so that you automatically receive news bulletins as they are put up on the system. This is much like the newswire services which you find in London clubs, except that the output is on your own screen. The disadvantage of this system is that you are charged for connect time to the system, even when no news is coming through.

The most popular section of The Source is called Parti. It is a conferencing system, equivalent to the CB Simulator on Compuserve, except that instead of users being able to chat to each other in real time, mailboxes are set up between them.

Parti is split up into conferences. Each conference is run separately, with its own organiser and subject. A wide variety of subjects are covered, including Children and Computers, the Social Aspects of Computer Communications, New Technology, Farming at Home and so on.

To participate — that's where the name Parti comes from — in any particular conference, you first need to join it formally. Once you have done so, all messages sent by other members of the conference are put in a special mailbox for you to read when you next log on. Similarly, any messages which you send while you are in the conference on Parti will be automatically dropped in the other members' Parti mailboxes.

Unlike CB Simulator, Parti encourages people to think more about their replies to messages before they send them. On CB everything is moving very quickly, and people tend to blurt out the first thing that comes into their heads. The drawback of Parti is that a conversation which takes only half an hour on CB could take a couple of weeks on The Source.

A special command enables two people to have a private chat: the command is Chat, as on Telecom Gold. Although it seems attractive in principle, I have not found much need to use this command, as you cannot get a display of the names of the people currently on the system. Only their IDs are accessible, and they are particularly unmemorable.

Another area which is of particular interest is the User Publishing section. Here, you can publish your programs or text files for other people to buy if they wish. This system has encouraged a number of interesting minority magazines to appear.

In addition to its specialised facilities The Source has many of the usual features found on a system of this type. Its electronic mail service uses more or less the same commands as Telecom Gold. There is also plenty of information for businesses, such as Stocks and Shares and company results, and reviews of cinema films and TV programmes — though only those which are showing in America. There is even a section for Soap Opera addicts, which tells you who is doing what to whom in each programme.

The Source costs $50 to join. Thereafter there are connect-time charges of $20.75 per hour at peak time and $7.75 per hour at standard time for access at 300 baud. If you use 1,200/1,200 or 1,200/75 baud, these charges increase to $25.75 per hour and $10.75 per hour respectively. The Source only accepts payment by direct debit from your credit-card account.

U.K. users encouraged

Unlike Compuserve, The Source bends over backwards to encourage British users to join. When I called up the head office in the U.S. to join, they took my number and called me straight back to save my telephone charges. Also The Source's prime time is set to British time, so the lower rate starts at 6p.m. as it does with U.K. systems such as Prestel.

One last point: I have noticed that some Source commands cannot be used because of the PSS connection — the Break command in particular. So the only way to get out of a long piece of text is to hang up. Unfortunately, if you do this The Source thinks that you are still logged in for up to 15 minutes after you have gone. This can do a bit of damage to your bill.

For further information you can contact The Source at Source Telecomputing Corporation, 1616 Anderson Road, Mclean, Va 22102. Telephone: (U.S. area code 703) 734-7500. PC

If you know of any new systems which you think would be interesting to other readers, drop me a line either by snail mail at *Practical Computing*, or electronically via Prestel mailbox 919993567, Telecom Gold 84:TCC051, The Source AAG008, or Compuserve 72236,3112. *Practical Computing* has a box on Telecom Gold, 81:JET727.

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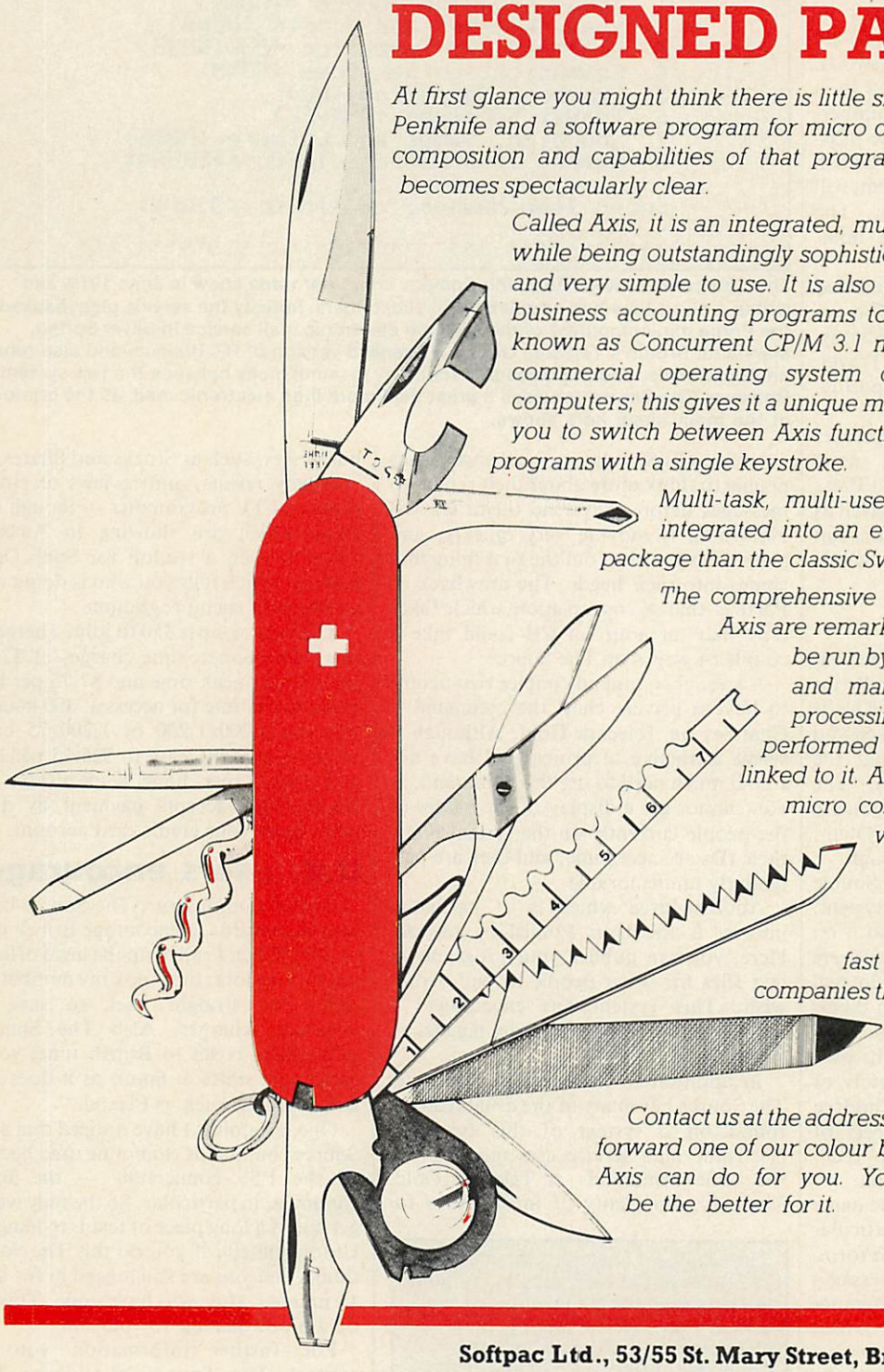

At first glance you might think there is little similarity between a Swiss Army Penknife and a software program for micro computers. A further look at the composition and capabilities of that program, however, and the analogy becomes spectacularly clear.

Called Axis, it is an integrated, multi-user business system which, while being outstandingly sophisticated in concept, is well proven and very simple to use. It is also one of the first fully integrated business accounting programs to run on the operating system known as Concurrent CP/M 3.1 multi-user, the most advanced commercial operating system currently available on micro computers; this gives it a unique multi-tasking facility which allows you to switch between Axis functions as well as other, non-Axis programs with a single keystroke.*

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by Mike Lewis

Sound advice for safer sorts

Conventional algorithms sort words alphabetically, but if you sort on their sound you may find your database becomes much easier to use.

TAKE A LOOK at the list of surnames in the box at the top of this page. Can you see what sequence they are in? At a quick glance you might think that they are listed alphabetically, but look closer and you will see that this is not the case. If you still have not got it, try reading the list aloud.

The answer is that the names are in phonetic sequence. Names that sound alike are close together in the list: Cohen and Cowen, for example, or Carlton and Charlders. Grouping names according to their sound rather than their exact spelling can add sparkle to any database system. Think how much easier it would be to find the record for Mr Johnson without having to worry about whether he is Johnsen, Jonson or even Johansenn.

One way of going about this is to use a technique known as the Soundex algorithm. This method has been around for many years, and has long been popular with designers of airline reservation systems. It has more recently been put to work in some micro database-manager packages, the best-known examples being the Whatsit system on the Apple family, and Southdata's Superfile package.

Four-character string

The idea behind Soundex is very simple, and there is no reason why you should not make use of it in your own programming. Basically, it takes a name and reduces it to a shorter string of characters known as a phonetic key. The first letter of the key is always the same as the initial letter of the name. This is followed by a digit, in the range 1 to 6, which corresponds to a phonetic grouping of the next letter in the name. Thus, the sibilants, like S and Z, are in group 2, while the dental letters, D and T, are in group 3.

Subsequent letters of the name are converted to their group numbers and added to the key. However, vowels are ignored, as are the letters H, W and Y. Furthermore, a group number is only added to the key if it is different from the previous one. This ensures, for example, that the CKS combination in Nickson behaves in the same way as the X in Nixon; both spellings produce a phonetic key of N25. Finally, the phonetic key is truncated, if necessary, after the first four characters.

Simple to program

The rules are defined more fully in the box, and the listing shows how simple it is to program the conversion in Basic. Of course, the technique works just as well with any sort of words, not just names, and it is not limited to English. In fact, Soundex really comes into its own in applications that involve accessing multi-national files.

Naturally, the algorithm is not perfect. There is a small set of English names like Belvoir, pronounced "Beaver" and Clough, "Cluff", which do not produce a correct phonetic key. Other weaknesses are more subtle. A search for Rogers R262 would fail to find Rodgers R326, for example. But in a very high proportion of real-life cases the technique works correctly.

Having produced the Soundex keys, the next step is to put them to work. One way of doing this would be to use them to index a name and address file. This highlights an interesting property of the key. Because

(continued on next page)

Case	Card
Casey	Chard
Chase	Carter
Cecil	Cartier
Caldicott	Charter
Cohen	Charteris
Cowen	Carroll
Care	Charles
Carr	Carlton
Carrier	Charlders
Corry	Coren
Curry	Cairns
Carson	

A list of names placed in order — but not alphabetical.

Names	Key
Carr, Carrier, Curry	C6
Eaton, Eton, Eden	E35
Green, Greene, Gruhn	G65
Matthews, Matteus	M32
Schofield, Skophill	S214

The Soundex keys generated from some similar-sounding sets of names.

How Soundex works

Here are the rules by which Soundex converts a name or other word into a phonetic key.

1. Make the first letter of the key the same as the first letter of the name.
2. For each subsequent letter in the name, proceed as follows:
3. Convert the letter to a group number:

Letters	Group
B,F,P,V	1
C,G,J,K,Q,S,X,Z	2
D,T	3
L	4
M,N	5
R	6

Ignore letters A,E,H,I,O,U,W and Y in the name, as well as any non-alphabetic characters, such as apostrophes or hyphens.

4. If the group number is different to the previous group number, add it to the key.
5. Repeat the steps 3 and 4 until either the name is fully converted or the key reaches four characters.
6. If the application involves making the key a fixed length, for example if it is to be used for indexing, space-fill it to four characters as necessary.

```
500 'PHONETIC KEY ROUTINE:-
      Converts the name in FULL$ to a phonetic key, according
      to the Soundex algorithm; the result is stored in PKEY$
510 CODELIST$="01230120022455012623010202"      'Phonetic codes corresponding
                                                 to the letter of the alphabet
520 PKEY$=LEFT$(FULL$,1)                        'Pass 1st. char. unchanged
530 J%=2                                        'Pointer to char. within FULL$
540 WHILE J%<=LEN(FULL$) AND LEN(PKEY$)<=4:
      CHAR%=ASC(MID$(FULL$,J%,1))-64            'Numeric equivalent of next char
550     IF CHAR%>=33 AND CHAR%<=58 THEN
            CHAR%=CHAR%-32                      'Convert lower case to caps.
560     IF CHAR%>0 AND CHAR%<=26 THEN
            CODE$=MID$(CODELIST$,CHAR%,1):
            IF CODE$<>RIGHT$(PKEY$,1) AND CODE$<>"0" THEN
                PKEY$=PKEY$+CODE$
570                                             'Add coded value to phonetic
                                                 key, unless it is same as
                                                 previous one or group 0
580     J%=J%+1
590 WEND
600 RETURN
```

(continued from previous page)

there are only 26 times 6 times 6 times 6, or 5,616 possible Soundex codes, it is feasible to compress each key into just two bytes — or even into 13 bits, but let's keep the programming simple. This compares favourably with anything up to the 20 bytes which are required for storing the actual surnames.

To make an enquiry, the user would enter the required surname, or an approximation of it, and the program would use the index to access all like-sounding names. It would then display these names on the screen, along with other important details such as the address. The user would then select the one that was needed, and the program would process the relevant record.

A Basic implementation of the Soundex algorithm.

Although this two-stage procedure might sound a trifle long-winded, it is often much quicker in practice than the traditional approach of accessing the record by the exact name. This is partly because it is faster for the program to search the compressed index, and partly because the user is saved the trouble of spelling the name exactly right. I have seen this very system in action on a live database of 6,000 names, and it never fails to impress. PC

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```
                        INVOICE                    <0>##########
To  #<1>##########              From: G. W. Ltd
    #<2>##################          55 Bedford Court Mans.
    #<3>##################          Bedford Avenue
    #<4>##########              London W.C.1.
    #<5>#######                 Tel: 01-636-8210

Date<6>##.##      Tax point<7>##.##      Agent<8>###

Quantity  Description                Cost     Tax      Total
<9>###  <10>##############          <11>##   <12>##   <13>###
<14>##  <15>##############          <16>##   <17>##   <18>###
and so on
          Total....<19>######              Tax....<20>####
```

<??> items <1> to <5> internal command to request name, input, and then search an address file for details.
<??> items <6> to <7> request date input and validate.
<??> item <8> request agent number and validate range.
<??> item <9> request quantity, validate range.
<??> item <10> request description, search file, accept, and calculate fields <11> <12> <13>. if finished invoice then calculate fields <19> and <20>

Now comes the more valuable facility. You can provide the 'FORM' with file-related instructions, not only to request a 'console' input for file search against names, and stock, but after the invoice is finished, the fields you have selected may be passed to related files.

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Then send fields <9> , <10> , <11> to product analysis file.
Then send fields <0>, <1>, <7>, <19>, <20> to V.A.T. file.
Then send fields <10> , <11>, <12>, <13> to Nominal ledger. Do you see?

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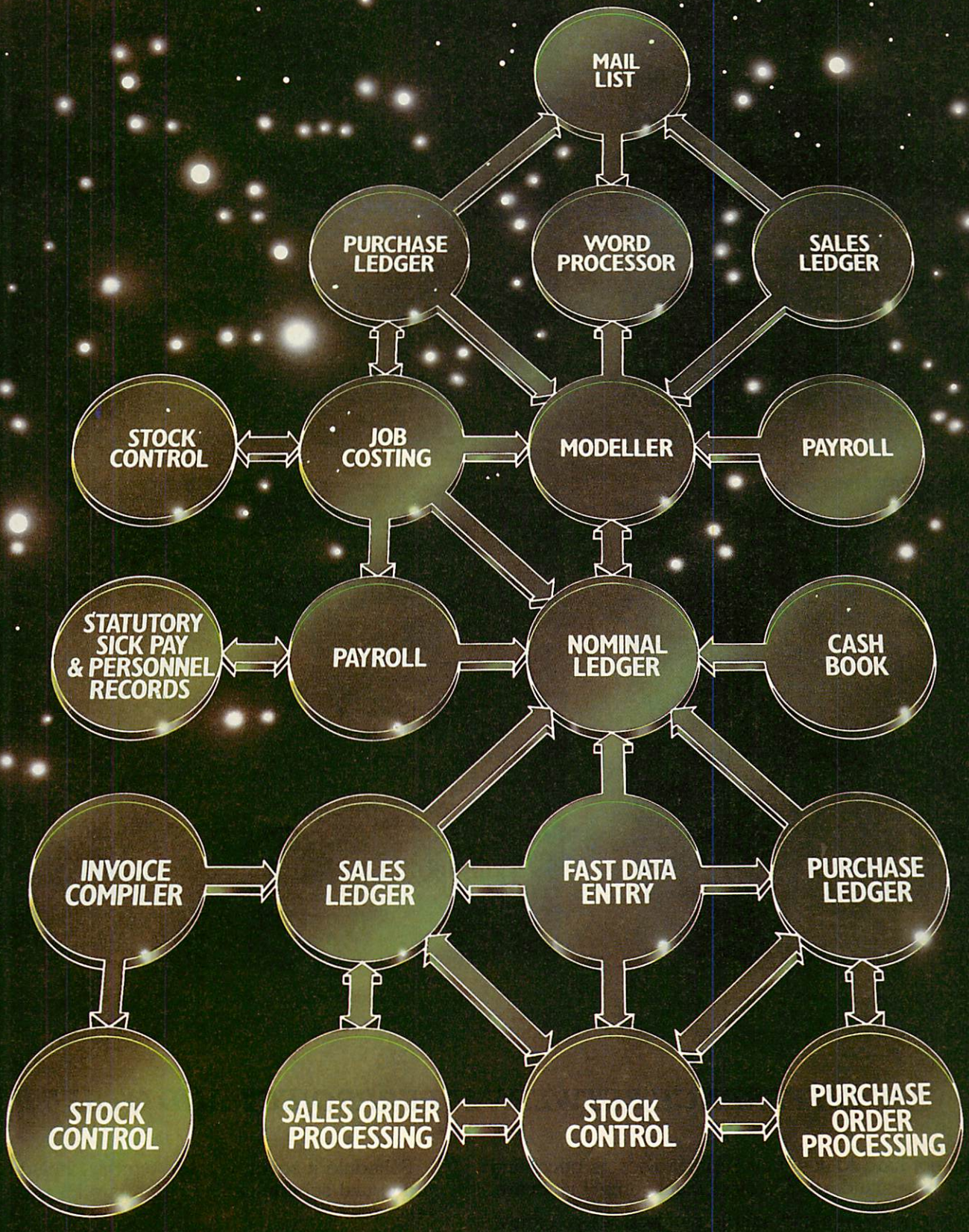

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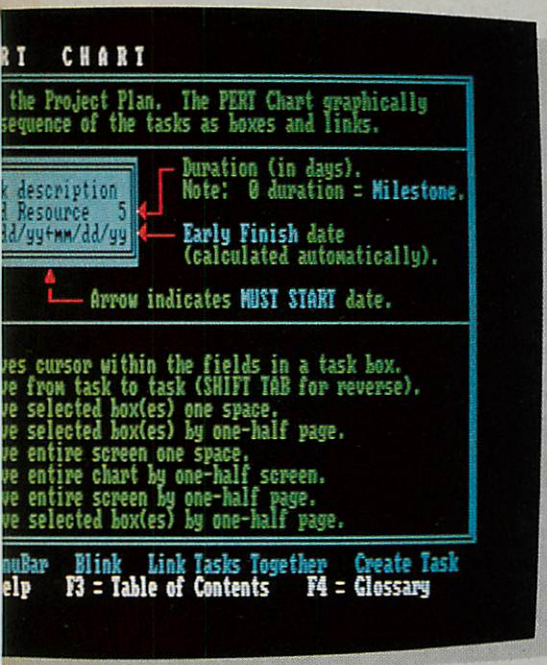
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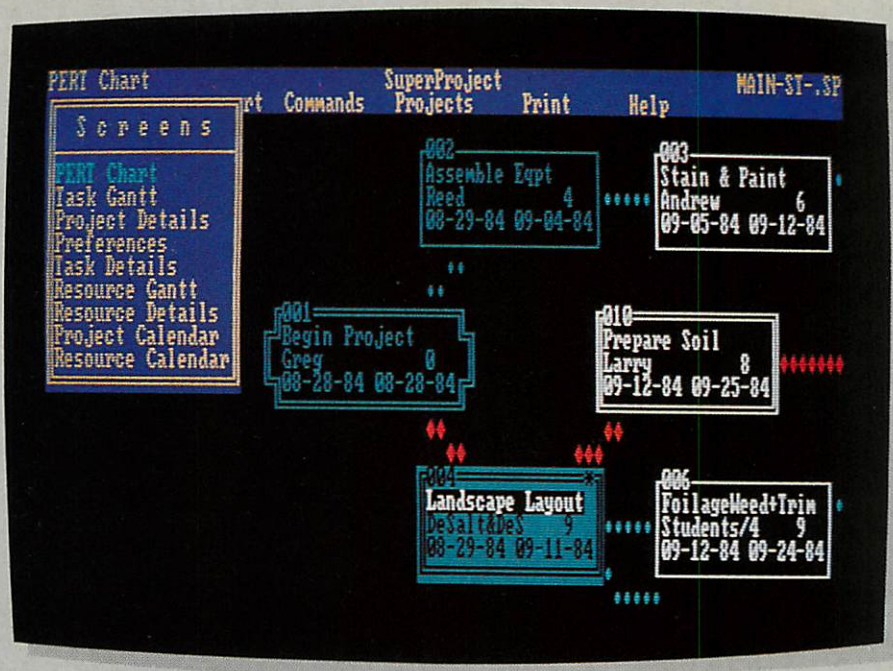
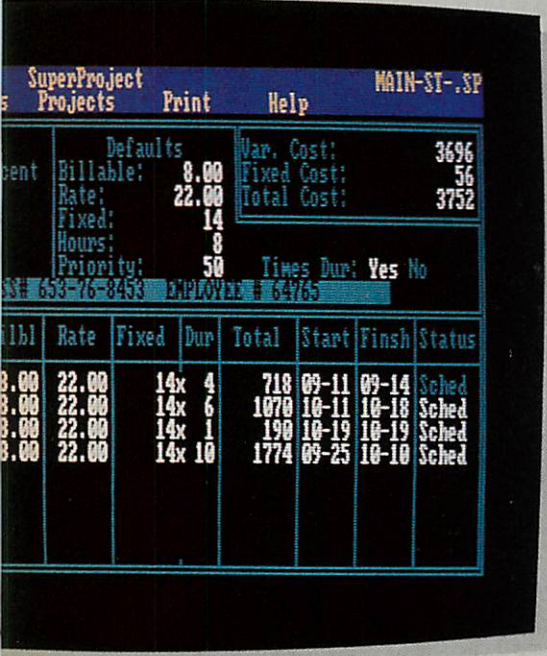
ves cursor within the fields in a task box.
ve from task to task (SHIFT TAB for reverse).
ve selected box(es) one space.
ve selected box(es) by one-half page.
ve entire screen one space.
ve entire chart by one-half screen.
ve entire screen by one-half page.
ve selected box(es) by one-half page.
nuBar Blink Link Tasks Together Create Task
elp F3 = Table of Contents F4 = Glossary

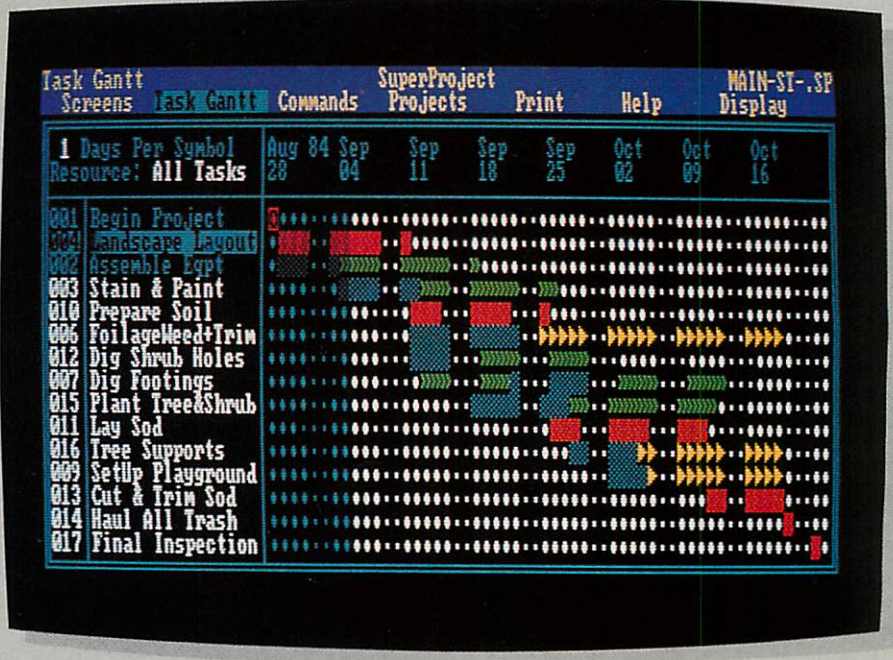
een help a keystroke away.



Create your entire project on screen.



see everything on every resource.



Schedule tasks over weeks, months, even years.

THE DIFFERENCE BETWEEN SUPERPROJECT AND OTHER PROJECT

It's not hard to see why SuperProject is becoming the new standard in project management software.

Bright colours and simple symbols let you know exactly where you stand, and its advanced graphics shine out even on monochrome screens.

But the real beauty of SuperProject lies in what it can do for you.

Like help you plan any project (from the smallest up to a planning problem the size of the Alaska Pipeline) right on the screen. And right to the last detail.

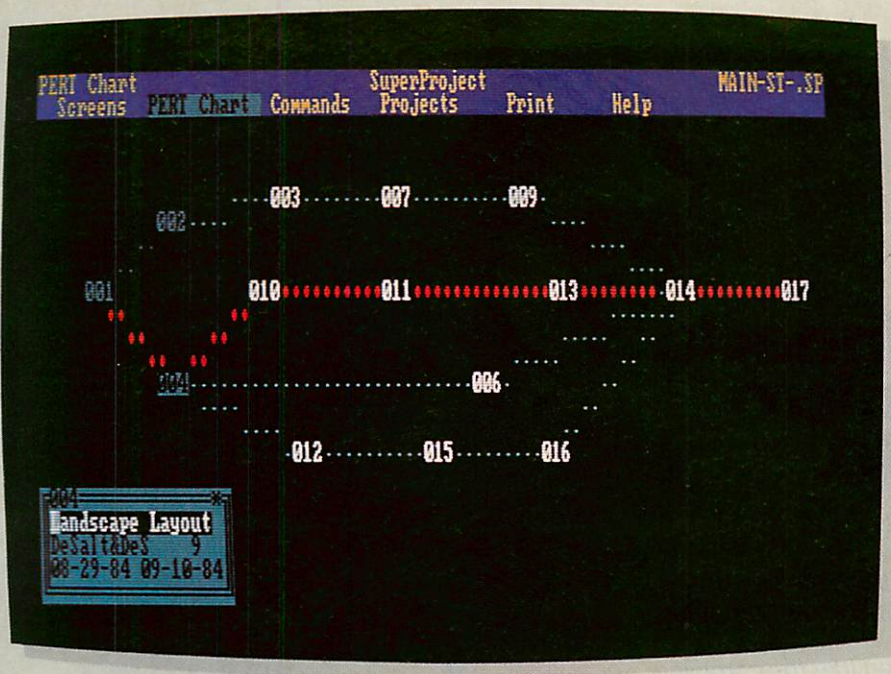
Schedule it seven ways to Sunday, including individual schedules and calendars for every resource.

Budget it down to the last penny, taking into account fixed, variable and total costs.

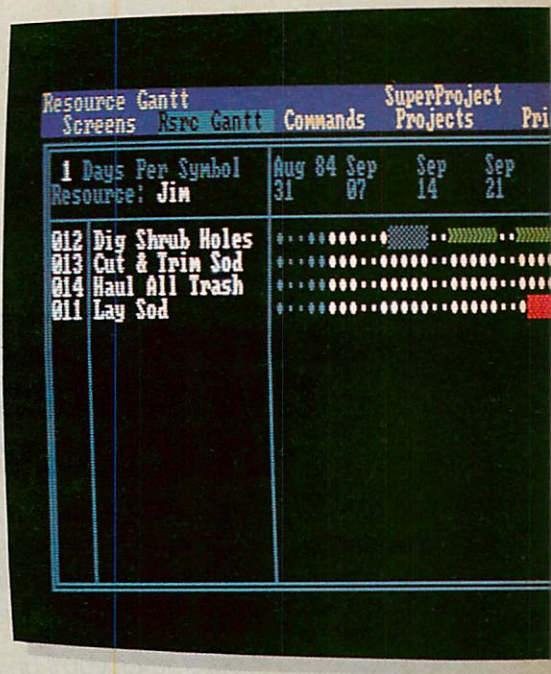
Have any change you make immediately reflected throughout the entire program.

Print every screen, even while you work.

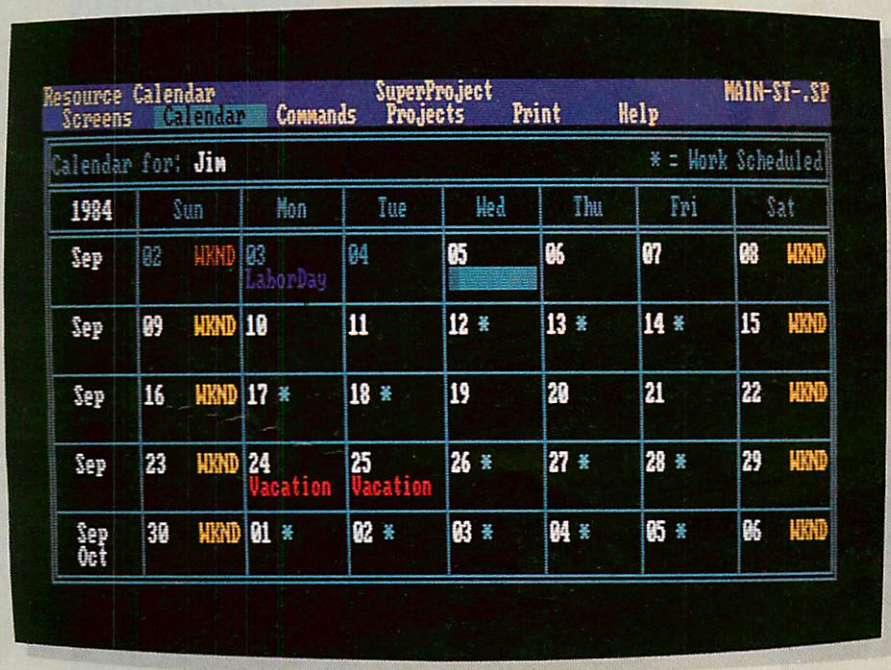
And do it all by following simple menus or by using fast command keystrokes.



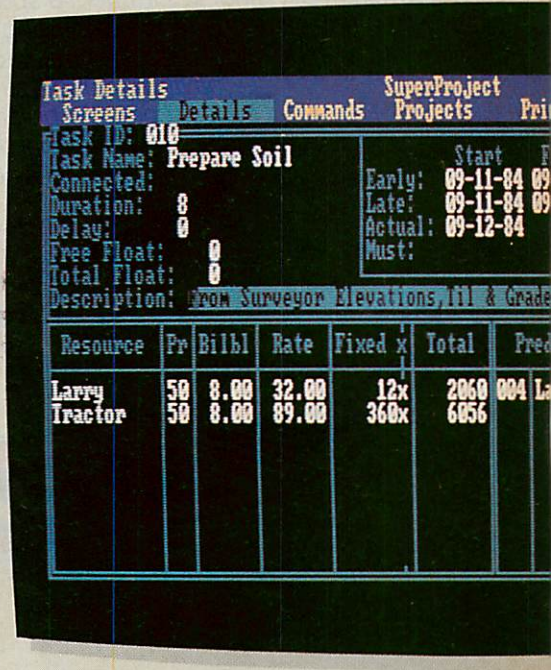
Unique project overview lets you see the big picture.



SuperProject automatically ale


Resource Calendar
Screens Calendar Commands Projects Print Help
SuperProject
MAIN-ST-.SP
Calendar for: Jim
* = Work Scheduled
1984 Sun Mon Tue Wed Thu Fri Sat
Sep 02 WKND 03 LaborDay 04 05 06 07 08 WKND
Sep 09 WKND 10 11 12 * 13 * 14 * 15 WKND
Sep 16 WKND 17 * 18 * 19 20 21 22 WKND
Sep 23 WKND 24 Vacation 25 Vacation 26 * 27 * 28 * 29 WKND
Sep 30 WKND 01 * 02 * 03 * 04 * 05 * 06 WKND
Oct

SuperProject outdates other project calendars by also providing calendars for every resource.



Track fixed, variable, a

MANAGEMENT SOFTWARE IS EVEN MORE GRAPHIC THAN THIS.

To take your planning and analysis even further, you can directly transfer project information into SuperCalc 3 Release 2 and other leading spreadsheets, and produce customized reports and charts.

To see how SuperProject can give your project management a clear advantage, visit your Sorcim/IUS dealer or send for a free demo disk. After one look, you'll find it's hard to see yourself using anything else.

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Finding a little more help with Supercalc

Sorcim's spreadsheet program may not quite rival VisiCalc for popularity, but it has picked up a strong following among IBM PC and CP/M users. Peter van der Linden assesses some of the books on the subject.

SPREADSHEET SOFTWARE is so basic a part of modern microcomputer systems that it is easy to forget what a relatively new application it is. Only seven years ago there were no spreadsheet packages.

Nowadays the market is dominated by a small number of heavily promoted products. One of the main offerings in the second division is Supercalc, produced by the Sorcim Corporation. It is available for many CP/M-based computers, and lately also for the IBM PC.

Supercalc for the IBM Personal Computer is essentially an informal book. The large pages — almost A4-sized — have a typewritten print face and are spiral-bound. A chapter at the end promises a prepared disc with all the examples. There is an excellent introduction to the PC hardware, which should enable even complete novices to get started. The style is quietly factual: flowing but not flippant. This book is very much a description of how to write your own templates in Supercalc, rather than a selection of other people's.

Supercalc: Home & Office Companion is an expanded version of a similar work directed at VisiCalc. The authors present 63 Supercalc models which provide a comprehensive mix of small business and personal applications. Each model has three sections: an introductory text, the display when the model is run, and a listing of the instructions to set the model up. All the models and sample executions were reproduced directly from computer prints so accuracy should be assured. This is a well-produced work, presenting many standard models, though there is no tuition content showing readers how to adapt or write their own models, and some of the models have an American bias. Nonetheless, the larger print size and the attractive line illustrations make this a stylish recipe book.

54 Supercalc Models delivers exactly what the title suggests: a collection of financial, statistical and mathematical

models. Some of the templates, such as the Chi-squared statistical test, are rather lengthy and you can send off for a floppy disc containing the models. The financial models are a bit thin — would you really use a spreadsheet to calculate the remaining balance on a loan? — but the statistical templates more than compensate for this, with a wide range of models including all the standard formulae. *54 Supercalc Models* will be of most benefit to an existing Supercalc user who wants to acquire a wider range of models.

Supercalc! The Book is the ambitious title of Donald H Beil's reference work. It is a guide to the capabilities of Supercalc for new users who wish to produce their own models. The text is very comprehensive, and different chapters cover a wide range, from getting started through to debugging spreadsheets, documenting them and installing them for naive users. The chapters concerned with commands and built-in functions are well laid-out in alphabetical order. Few, if any, complete templates are shown to the reader, but after finishing this book you should be able to write your own.

Randall McMullan's *Supercalc Prompt* is a little unusual in that it was written and printed in England. Hence all the examples and units are in familiar notations. The book is in three parts. The first section summarises how to begin using the simpler features. The second part presents several not very ambitious templates. The last section gives a little more information for advanced users, including examples of graph output.

McMullan's book ends just as it starts to get interesting. Nonetheless, there is no doubt that the reader is given a good value from a book that combines both an elementary reference work and a list of ready-made templates. A particularly strong advantage is the use of diagrams rather than text to prompt beginners into the correct sequence of actions for various results. The book should also be valuable to someone who wants a top-level view of the features Supercalc provides. PC

54 Supercalc Models by Robert H Flast. Published by Osborne/McGraw-Hill, 244 pages, £14.95. ISBN 0 88134 118 5

Supercalc for the IBM Personal Computer by Edouard Desautels, Michael Laric and Ronald Stiff. Distributed by Transatlantic Book Service, 162 pages, £15.25. ISBN 0 697 09930 X

Supercalc: Home & Office Companion by Elna Tymes and Peter Antoniak. Published by Osborne/McGraw-Hill, 293 pages, £19.95. ISBN 0 88134 113 4

Supercalc Prompt by Randall McMullan. Published by Collins, 154 pages, £7.95. ISBN 0 00 383004 7

Supercalc! The Book by Donald H Beil. Published by Prentice-Hall, 287 pages, £20.65. ISBN 0 8359 7305 0

DOES WORKING ON LOTUS 1-2-3 MAKE YOU SEE RED?

Granted, Lotus 1-2-3™ can be a fast spreadsheet.

Except when you first buy it, take out the five floppy disks, study the manual to figure out which ones do what, put the plastic Thingymejig over the keyboard, and begin reading about all the installation procedures you need to get the thing up and running.

Or if you never make a circular calculation (any simultaneous equation, even something as simple as "bonus equals 10% of profit after bonus") when doing a complicated spreadsheet.

By the time 1-2-3 calculates it correctly, you may have retired.

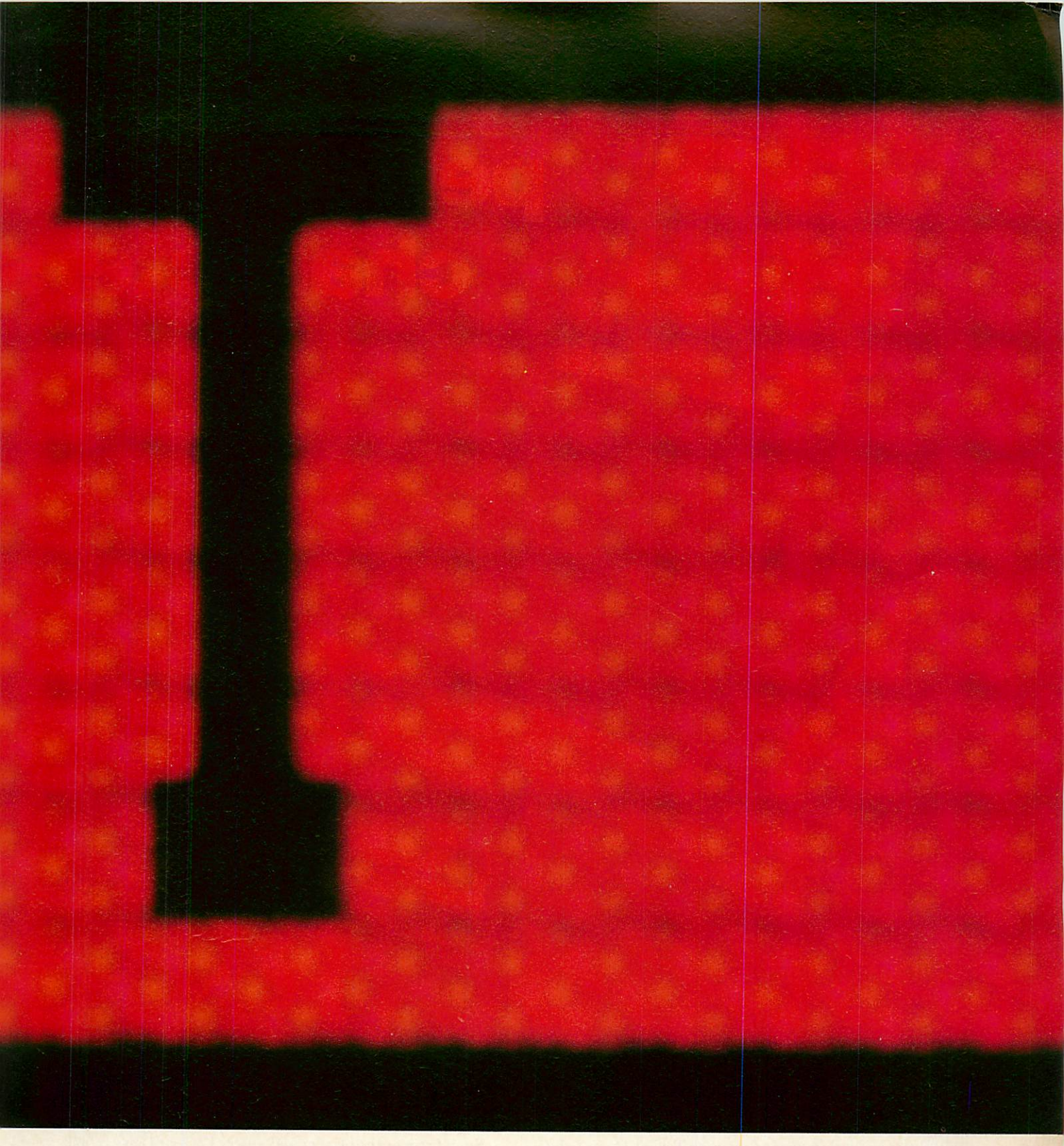
Or if you'd like to plot your data with a single keystroke, because it can take several minutes (including a disk change) just to start the process.

Or if you'd like to quickly create a file directory under program control. 1-2-3 can't do that at all.

What's the point of all this?

We'd like you to go down to your software dealer or send for a free demo-disk and see a new product called SuperCalc® 3 Release 2, which, unlike Lotus 1-2-3, does all of the above.

Along with a larger spreadsheet. Vastly superior graphics. Incredible speed (that becomes even faster when used with the 8087 or 80287 math co-



processors, which 1-2-3 doesn't support). And more.

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But don't believe us about all this. Go take a look.

After you do, one thing should become obvious.

What are you waiting for?

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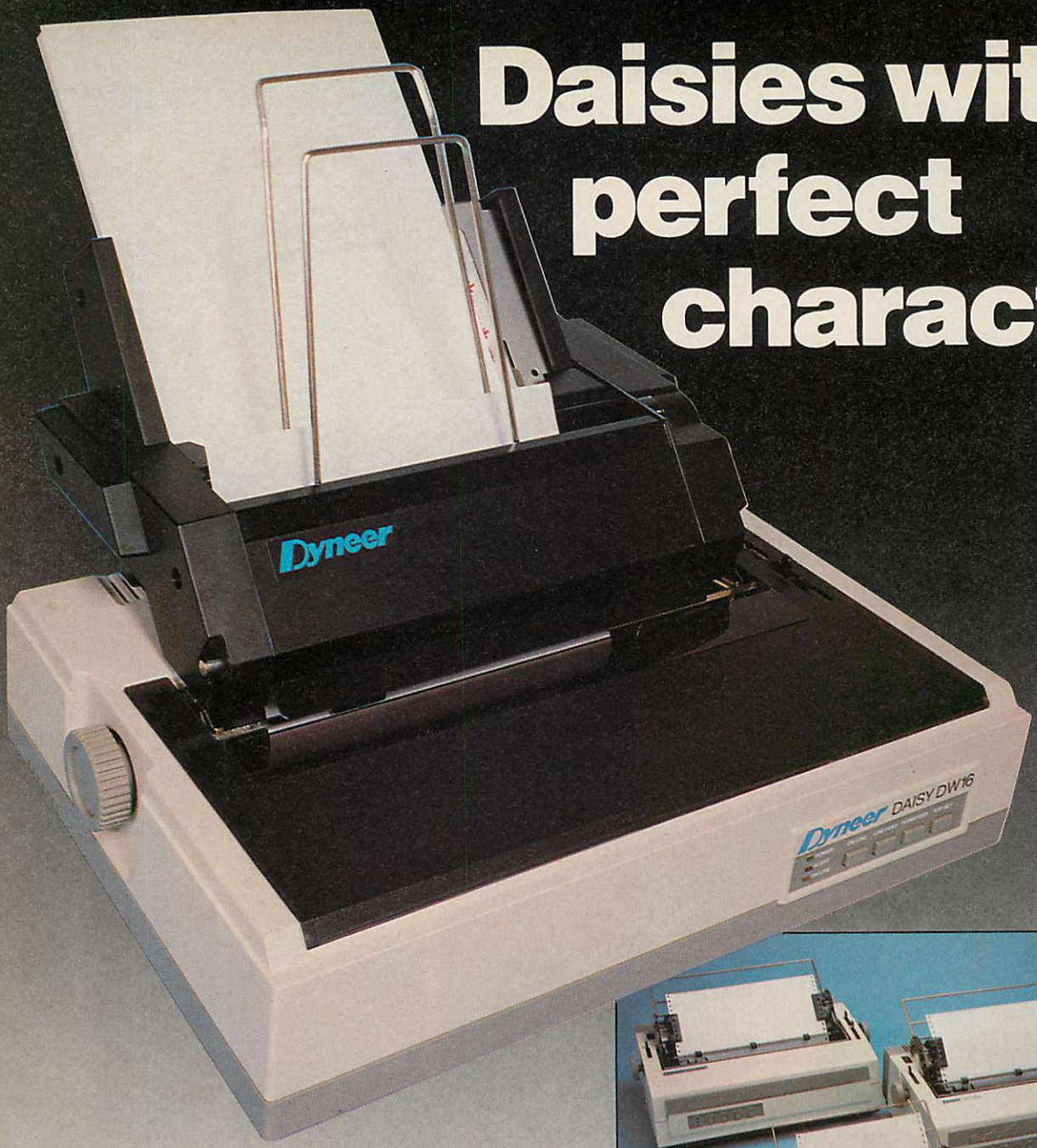
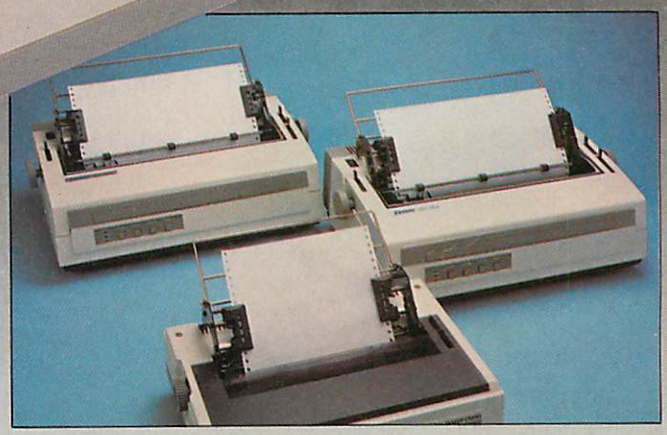
Daisies with perfect characters





THE DYNEER DW16 – pictured above – offers Daisy-Wheel-Perfect print at a price you'll find difficult to believe.

With a print speed of 16 cps (Shannon Text at 14 cps), the DW16 features bi-directional printing up to 10 inches wide on 12 inch (max) paper, and offers a choice of tractor or friction feed systems.

If you need higher performance, the DW20 and DW36 offer maximum print speeds of 20 cps and 36 cps respectively, printing up to 13.2 inches wide on 17 inch (max) paper.

And all models are available with optional automatic cut-sheet feeders for users needing maximum correspondence throughput.

But whatever the print speed, every Dyneer Daisy is built to the most stringent engineering standards and is compatible with most popular word-processing packages. And all feature the Dyneer Hallmarks: Quality, Reliability and Unbeatable Price/Performance.

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NEXT MONTH

SPECIAL SECTION

IBM AND THE COMPATIBLES

Will IBM survive? We assess its continuing commitment to the personal computer marketplace in the light of the killing of the PC jr, the ageing of the PC and the limited deliveries of the AT. **Robert Piper** provides a thorough guide to the best PC-compatible micros, and we survey the software.

REVIEWS

OPTIONS

Most of the interesting new software provides different ways of doing things: Options, Helix and Tick Tack are three scheduled for review. **Susan Curran** will be taking an in-depth look at Perfect Writer II, while on the hardware front we will be lifting the veil on Amstrad's new launch.

TOP TEN BUSINESS PACKS

Which are the Top Ten business programs, and why? **Ian Stobie** surveys the field and separates the best from the rest. Plus there will be practical information on a range of topics, from proportional spacing in WordStar to the marking and analysis of multiple-choice tests.

Don't miss the June issue of

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Compilers like these don't grow on trees

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Oxford Pascal is Standard

Oxford Pascal is a full extended implementation of Standard ISO Pascal. This means that you can compile any Pascal program (subject to size), written on any computer, anywhere.

Oxford Pascal is Compact

Because it compiles into P-code, Oxford Pascal reduces programs into the most compact form possible. In fact it allows you to pack more code into your BEEB than any other language, and should your programs become too large, you can still use the CHAIN command to overlay limitless additional programs without losing data.

Graphics & Sound Extensions

In addition to the entire Pascal language, Oxford Pascal features a whole range of Graphics (all modes) and sound extensions designed to make maximum use of the BBC Computer. Oxford Pascal also provides numerous extensions such as hexadecimal arithmetic and bit manipulation instructions.

Oxford Pascal in Education

In Education, Oxford Pascal is fast becoming a *de facto* standard. It is already the most popular Pascal on the Commodore 64, and will soon be released for the Spectrum and the Amstrad. In fact, Oxford Pascal will soon be available for 90% of the computers installed in the U.K., and is already available in German, French, Swedish, and American versions. **Students and teachers alike find that it makes sense to use a standard implementation of Pascal across the whole range of educational micros.** Call us for details of our generous educational discounts.

Manual

Both these compilers come with a manual which has been carefully designed, not only as a quick reference guide, but also as a full tutorial for those new to Pascal.

Resident and Disc Compiler

Oxford Pascal comes in two forms:

For Tape Users...Oxford Resident Pascal. A compiler located largely in ROM which is available at any time. Programs can be written and compiled on the spot without disc or tape access, and compilation is fast enough to make using the compiler much like using the BASIC interpreter. Thus, learning Pascal is a simple interactive process. Some 15K of memory is available for user programs, the remainder being reserved for compiled object code.

For Disc Users...Oxford Disc Pascal offers all the above PLUS...a full disc compiler which is capable of using the WHOLE memory for Pascal object code, it is supplied with a powerful LINKER, allowing you to break large programming tasks down into separately compilable, easily-manageable files.

Friendly Error Messages

Many compilers produce little more than an error and line number to help correct mistakes in Pascal programs. Oxford Pascal however, gives you one of 49 friendly and informative error messages. Messages which not only indicate the reason for an error, but also print out the line in question with a pointer to the exact position where the error was detected.
Run-time errors are reported using line-numbers from the original source-program, with a full explanation of how the error occurred.

Powerful Editor

With Oxford Pascal there is no need for you to learn how to use a new Editor. Pascal programs can be entered in exactly the same way as BASIC programs, without the need to learn any new commands. When you are used to using Pascal, you will find our extensions to the Standard Editor even more useful. What is more, Oxford Pascal allows you to mix BASIC and Pascal together, in much the same way that you can mix BASIC and assembler. In fact you can, if required, mix all three together...BASIC, Pascal and assembler...in one program.

Stand Alone Code

Unlike other compilers, Oxford Disc Pascal allows you to compile on the BBC and then relocate your program so that it will run on the BBC **and** on the Electron. The relocated program will run without a Pascal **ROM** and can be loaded and run from tape or disc just like any other program.

This means that you can distribute or sell your software freely and without the need for **ROMs**, to run either of the above machines.

Price/availability matrix

	BBC 'B'	ELECTRON	C64	SPECTRUM
DISC	£49.95	Not yet!	£49.95	Available April 1st 1985
CASSETTE	£39.95	£59.95 inc. Cartridge	£22.95	

All prices are inclusive of VAT
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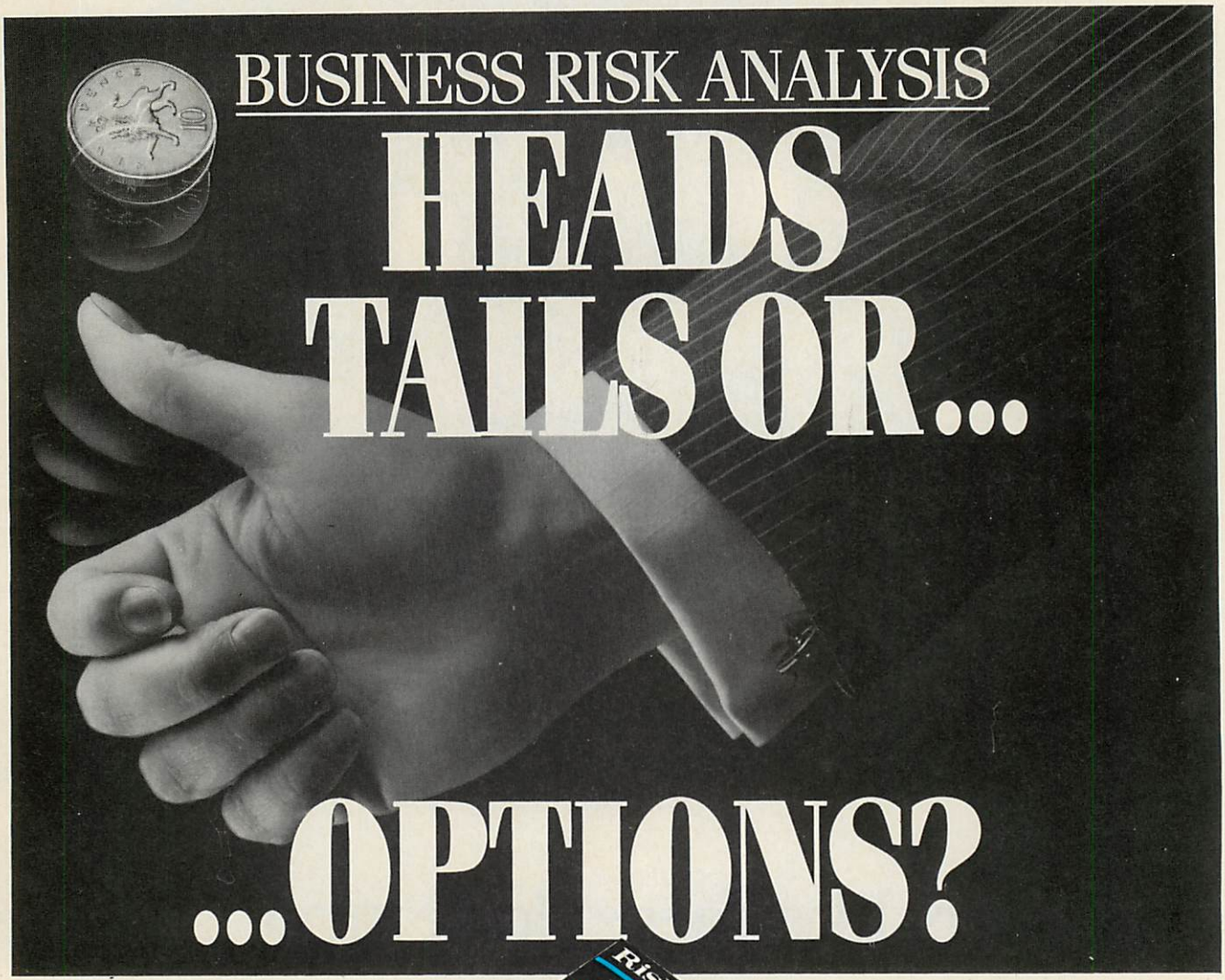

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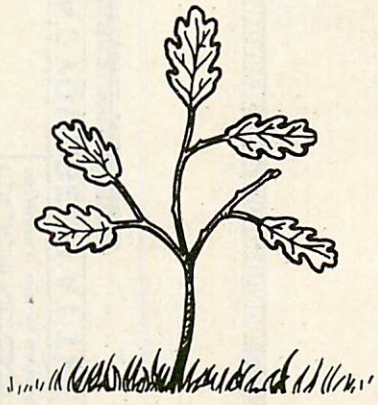

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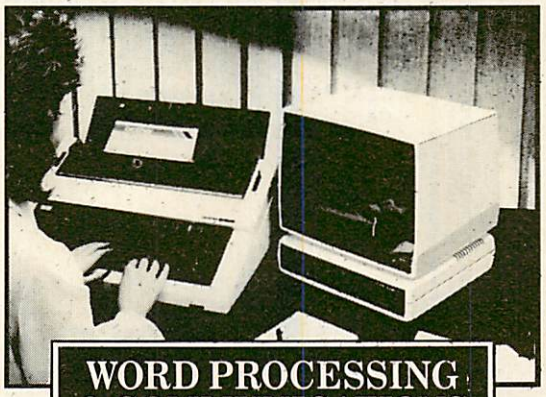

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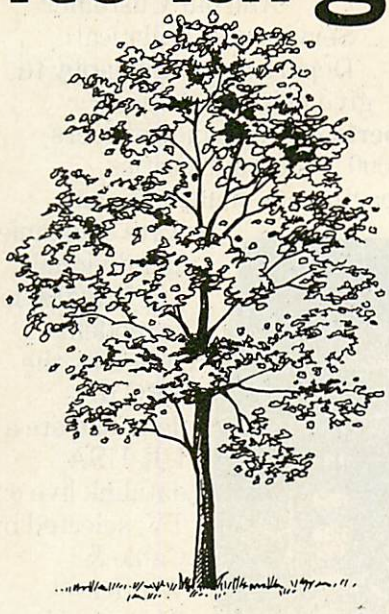

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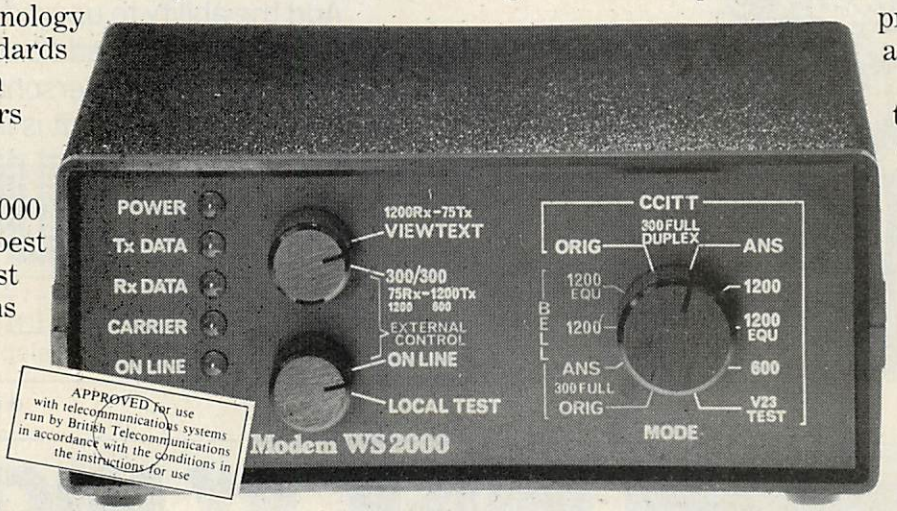

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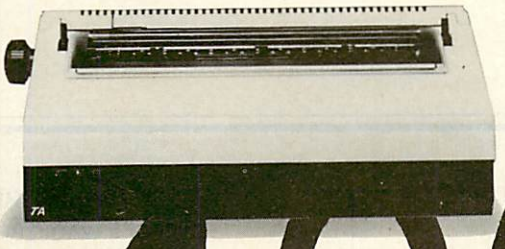

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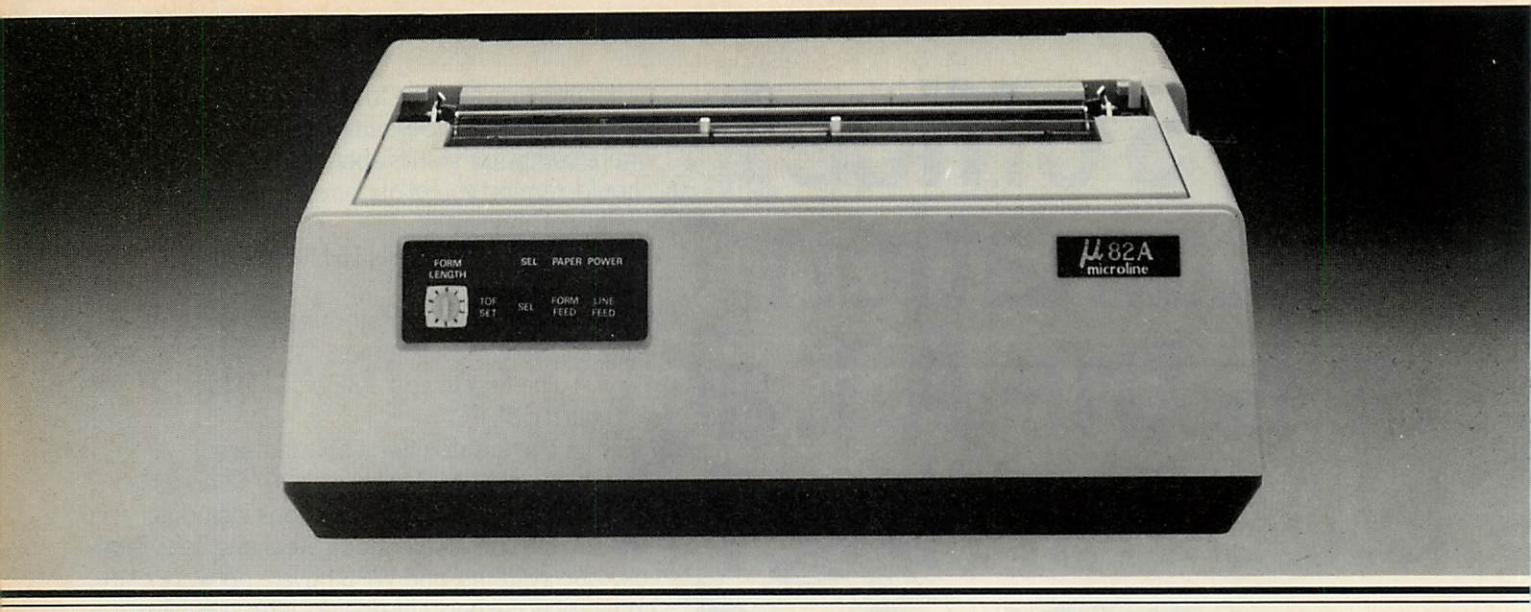

The MICROLINE 82A

FROM EXCELLENCE THE NEW OKI

Above we show you two printers (to the same scale). On the left is the OKI MICROLINE 82A - one of the most successful standard dot matrix printers ever manufactured. On the right is the printer that will become the NEW standard for dot matrix printers - the new MICROLINE 182 - from OKI.

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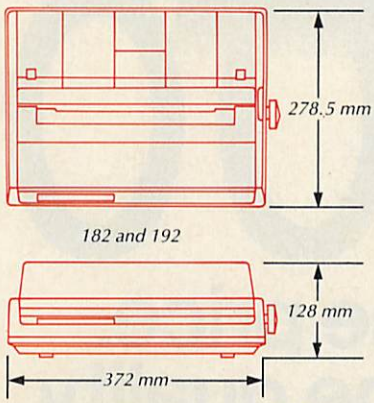

The dimensions of the larger Microline 193 are, length 524 mm, width 278.5 mm and height 128 mm. These dimensions do not include the platen and tractor unit.

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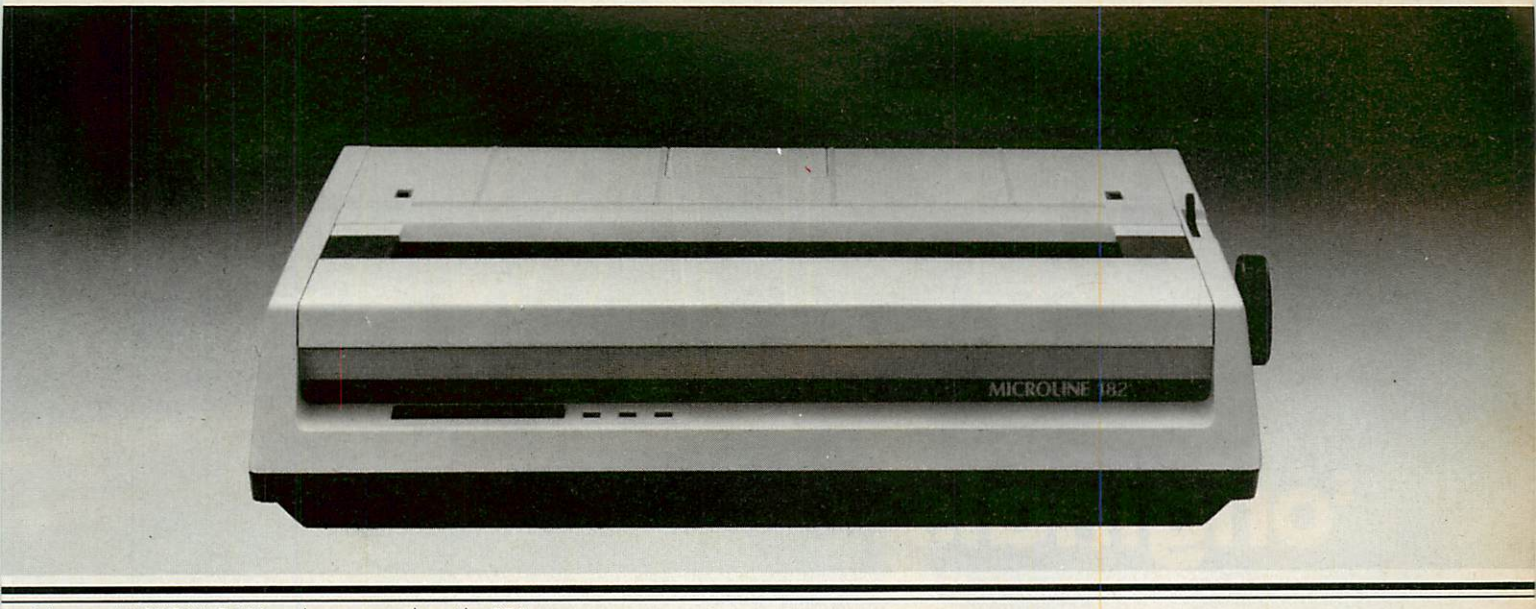

The new MICROLINE 182 to the same scale as the 82A

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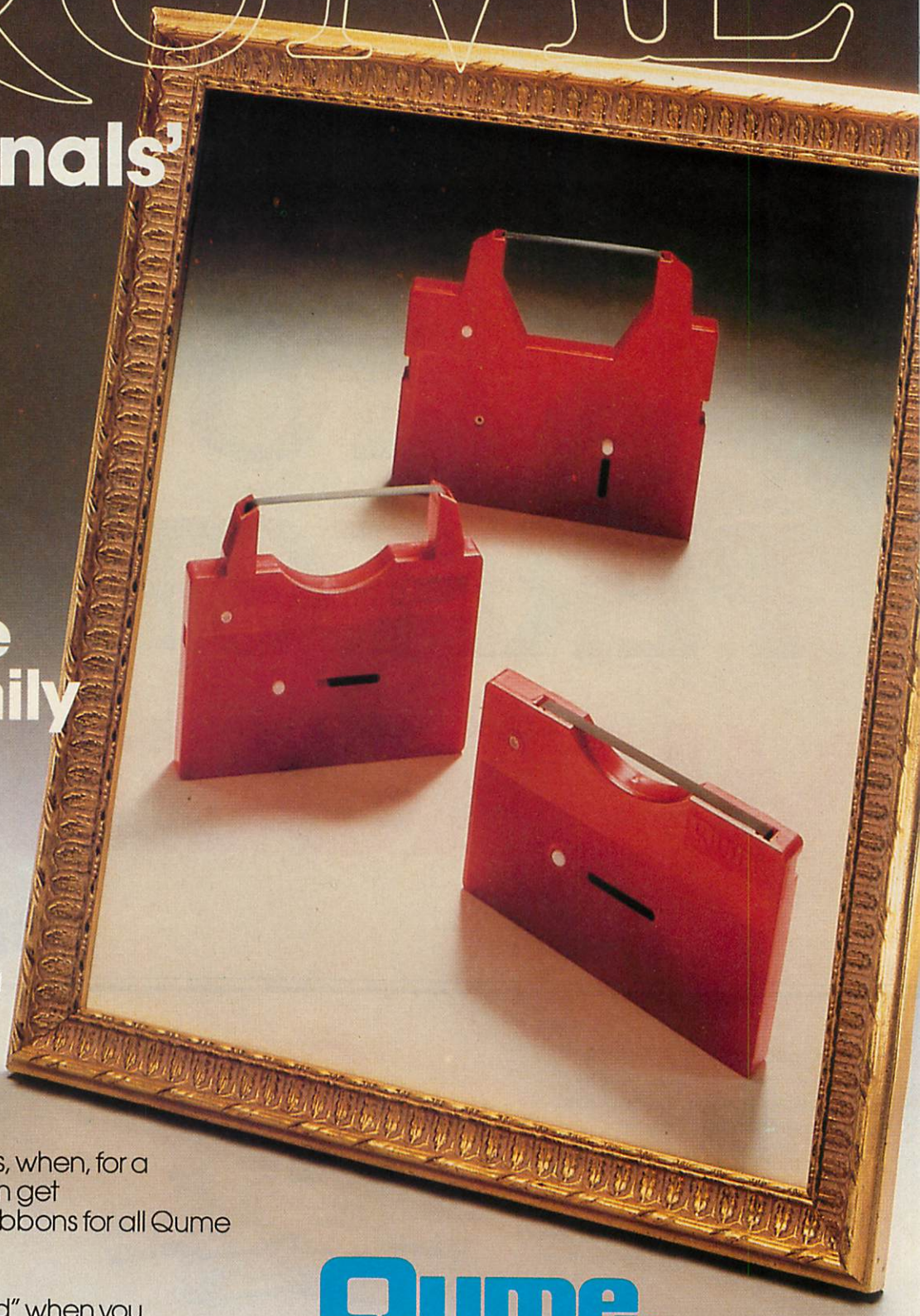

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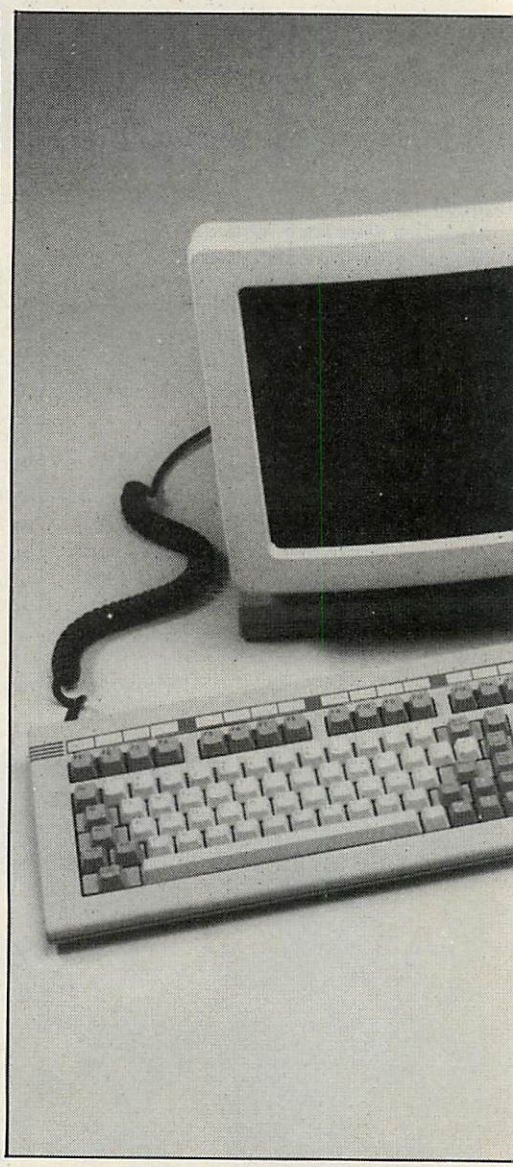
SPRITE

The IBM PC/AT will get there in the end, but this 80286-based micro can do it now — practical multi-user operation on a desk-top unit. Glyn Moody assesses Jarogate's state-of-the-art machine.



FRUIT MACHINES and heart-lung monitors are among the products of the micro manufacturer Jarogate Limited. But the Brixton-based firm is probably more familiar — to *PC* readers, at least — as a supplier of multi-processor black boxes such as the MP-5, based on the Z-80 chip.

More recently, Jarogate has added boards with 80286s to its range, and now it has come up with the Sprite, a single-processor multi-user system based on that chip. The basic processor unit costs £4,995, and comes with 512K RAM, a 21Mbyte Winchester and a 790K 5.25in. floppy. Terminals cost £650 each. The basic machines can handle two users.

RAM can be increased to 2Mbyte, and the hard-disc capacity to 150Mbyte. The top-of-the-range system costs £14,895. Extra terminals can be plugged in by adding an eight-port serial interface board for £495. Up to 16 users can be dealt with in all. The operating system is Concurrent CP/M 3.1, which has the added bonus of PC-DOS emulation, allowing many IBM programs to be run.

Externally, the Sprite is rather unusual in design. The main processor box is a low, deep rectangular slab, built in a battleship-grey, textured plastic. A non-functional grille along the front betrays the work of design consultants brought in by Jarogate to help it move beyond its image of a maker of crate computers.

At the front are the Toshiba floppy and Rodime hard discs. The floppy has a rather awkward door mechanism that makes opening difficult. Two fibre-optic pipes signal when the hard disc is powering up initially and when it is being accessed.

At the back of the machine to the right are the power socket, on/off switch and Reset button. To the left of this are the two serial ports for the first two terminals. A further 14 terminals can be hooked up by slotting in two serial boards, which are linked via edge connectors to small boxes, each with eight D-type serial ports. There are two serial printer ports, and one parallel port. A further two parallel interfaces are available internally. At the top of the back panel is an Ethernet port.

Two screws at the rear release the lid of the unit to reveal a neat and packed layout. Behind the Rodime hard disc and the Toshiba floppy is the power-supply unit — or rather two power-supply units — to provide the Sprite's S-100 bus with the +5V and ±12V supplies it requires. The transformers are high-quality toroidal types.

S-100 backplane

There is a slightly noisy fan to cool the power supply, and another fan for the circuit boards which plug into the S-100 backplane behind the power supply. There are five slots, of which three are occupied in the basic model. The multi-layer boards are made and stuffed in London.

On top is the OWI, or Outside World Interface, which handles data transfer with discs and external peripherals. The board itself is one of the most densely populated I have seen, and is unlikely to be surpassed with present chip-packaging technology. Although the fan exhaust is warm, the test machine ran continuously for several hours without overheating problems.

An on-board Z-80B acts as an intelligent disc controller, and endows the system with predictive-read and deferred-write capabilities. The former tries to anticipate calls for disc data. For example if you are pulling data off a disc sequentially, the disc controller will automatically bring in the next block before you have asked for it. It is stored in a 256K cache which is quite separate from the RAM, greatly speeding disc-access times. The deferred-write feature enables you to carry on computing while the disc controller writes to disc.

Also included on the OWI is Intel's Ethernet chip. In addition to the standard Ethernet system, which is powerful but expensive, Jarogate is offering what it calls Cheapernet, designed to meet the less stringent needs found in many offices. Instead of an Ethernet transceiver costing £550, Cheapernet uses one which costs £50. Standard TV co-axial cable is used rather than costly Ethernet cabling.

The main processor board lies underneath the OWI, and at the bottom is the memory board; 256K DRAMS are used, with parity. To avoid slowing down the main 80286 processor, the RAM board has its own data and address bus.

The standard terminals supplied are Wyse 50s, like as those on the TDI Pinnacle, reviewed in the January issue of *Practical Computing*. The keyboard has a very positive feel to it, though the keys are slightly clattery. On-board intelligence allows you to configure the terminal in a variety of modes, adjusting most aspects of its operation. The terminal comes with the function keys ready-programmed with various operating-system commands.

Basic Benchmarks

The standard benchmarks listed in *Practical Computing* in January 1984 were run under Microsoft Basic. All timings are in seconds. The Sprite emerges as faster than the PC/AT, which also uses the 80286 chip, but slower than the TDI Pinnacle.

	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8	Av.
Sprite — 80286	0.5	1.6	3.5	3.5	4.2	7.8	11.6	9.3	5.25
Pinnacle — 68000	0.3	0.4	0.8	1.2	1.3	3.2	4.1	11.8	2.9
IBM PC/AT — 80286	0.5	1.9	4.6	4.7	5.2	9.1	14.6	13.5	6.8

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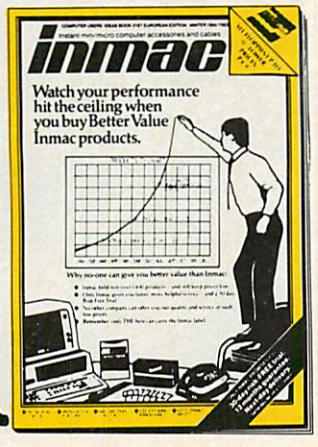

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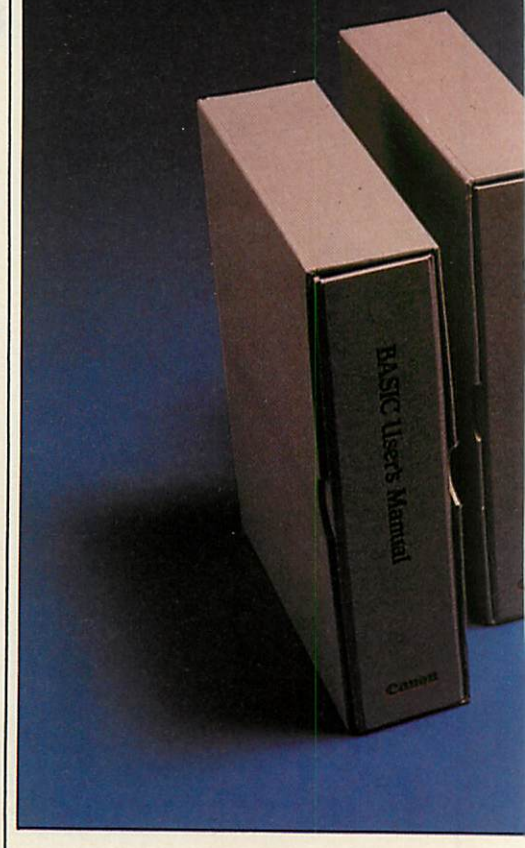
CANON A-200

The Japanese have arrived with a stylish, highly IBM-compatible micro equipped with a full 16-bit 8086 processor that looks like it's going to be excellent value for money. Robert Piper finds out whether it lives up to its promise.



THE NAME of Canon has become associated in the public mind with optical goods — cameras and copiers. In this field the company has built up an enviable reputation for quality and reliability; it clearly hopes this will stand it in good stead for its new departure into the world of IBM-compatible computers.

The A-200 is an attractive, conventional desk-top machine which uses the full 16-bit 8086 processor, and as a result runs noticeably faster than the IBM PC. All machines in the range are fitted with two 360K disc drives and 256K of RAM. Canon supplied the more expensive colour version for this review.

Looks professional

The Canon A-200 certainly looks a professional piece of equipment, finished in matching shades of cream with contrasting areas of grey on the fascia and keyboard. The footprint of the main unit, however, is rather large at 17.5in. wide by 15in. deep, and leaves little room on the average desk for the keyboard.

The front of the processor houses two half-height 360K drives with button-type locking devices. The button devices work well with a positive action, only requiring fairly light pressure to engage the drive. One small break with tradition is the use of green read/write LEDs in place of the conventional red.

Located beneath the drives are a DIN-style keyboard connector and a rather vulnerable Reset button. Although it took a bit of force it was quite possible to reset the system by pushing the corner of the keyboard back against the front of the main unit. If this happens accidentally it will, of course, have the result of losing all data held in the computer's memory at the time. The equally dangerous mains on/off switch is sensibly located towards the rear of the right-hand side, and is recessed to prevent inadvertent operation.

The rear of the Canon features the usual mains connections, including a secondary monitor outlet and the fan discharge grille. An RS-232 port and parallel port with a non-standard connector are included with every model.

Five expansion slots appear on the rear plate. One of them will always be used by the display adaptor, whether a monochrome or colour unit is used. The review machine had an IBM-style colour-graphics board with connectors for both RGB and composite-video monitors.

Getting inside the Canon is simply a case of removing four cross-head screws and sliding off the sheet-metal cover. The motherboard is remarkably small, occupying only half the available area on the base of the machine. It features the full 16-bit 8086 running at a surprisingly conservative 4.77MHz, which may help ensure software compatibility. However, most manufacturers who use this chip increase the clock speed to 6MHz or 8MHz, and this has the effect of making the machine dramatically faster than the IBM. Alongside the 8086 is a vacant socket ready to accept the 8087 numeric co-processor.

The standard A-200 is supplied with 256K of RAM which can be expanded to 512K with Canon-supplied expansion boards. These boards fit into a special expansion slot next to the display adaptor card, which uses the full 16-bit data path of the 8086 processor. This system reduces memory-access times and has already proved a success on the Olivetti M-24.

Specification

CPU: Intel 8086 running at 4.77MHz
RAM: 256K, expandable to 640K
ROM:16K, bootstrap and diagnostics
Dimensions: system unit 445mm. (17.5in.) by 380mm. (15in.) by 140mm. (5.5in.)
Keyboard: 83-key IBM layout, 10 function keys
Mass storage: two 5.25in. 360K floppy discs
Interfaces: RS-232C serial and Centronics parallel
Software in price: MS-DOS version 2.11 and Basica
Peripherals: Canon 256K memory expansion board £315
Price: monochrome £1,875; colour £2,295; prices do not include VAT
Supplier: Canon U.K. Ltd, Canon House, Manor Road, Wallington, Surrey. Telephone: 01-773 3173

To ensure compatibility with other manufacturers' IBM-compatible expansion boards, the remaining three full-length slots are standard IBM PC bus format. Unfortunately, Canon has not included an integral clock/calendar with the A-200, so if you want one it will have to be fitted in the expansion bus.

Located above the motherboard are two very compact half-height floppy-disc drives of Canon's own make. The power supply located at the rear of the machine is fully screened and appears to be large enough to cope with the most ambitious future expansion plans.

The keyboard is a beautifully finished copy of the IBM unit. Key layout is identical, so it lacks such useful extras as LEDs on Num Lock and Caps Lock keys and a separate Entry key on the numeric keypad. The Canon version has been shorn of excess material down either side,

Manufactured by National Panasonic, the colour monitor is compact and versatile.

making it much more compact. There are also two folding tilt legs to angle the keyboard towards the user if required.

Acceptable action

I found the key action acceptable, and the feel is undoubtedly assisted by the robust character of the unit in general. The review machine had no £ sign on the keyboard, nor was there a utility on the operating-system disc to enable the 3 key in Shift mode to produce one. Canon is currently in the process of rectifying this shortcoming.

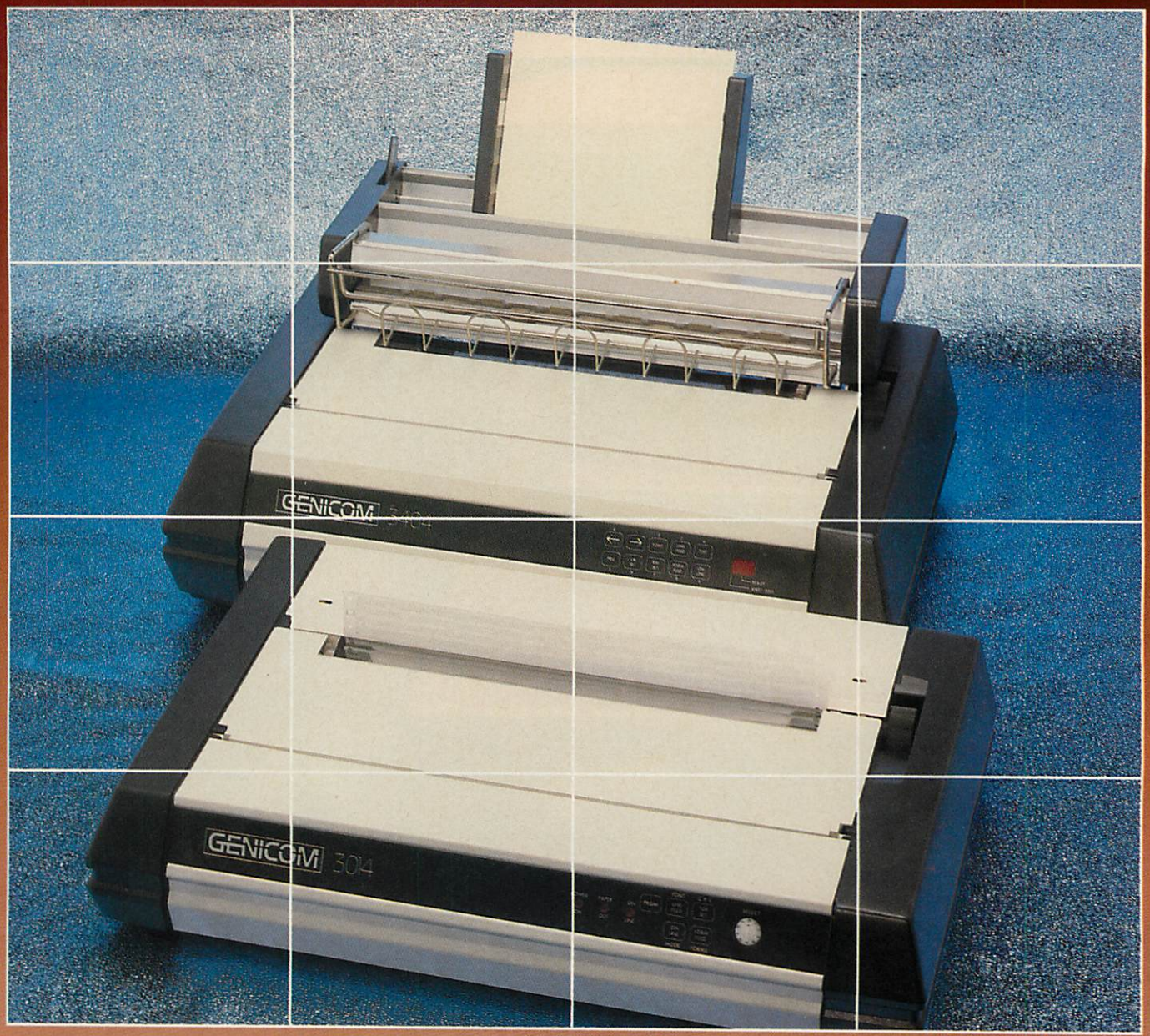
The 12in. colour monitor bears a remarkable resemblance to units supplied with other micros of oriental origin, and it came as no surprise to find that it is manufactured by National Panasonic. It is a well-styled unit, offering compact overall dimensions and a versatile tilt/swivel base. The on/off button and edgewise brightness and contrast controls are all located on the lower portion of the front bezel.

Resolution is identical to the IBM colour display and stability is good. Although the display was bright enough for use in the fairly dark test room, its performance in a brightly lit office may be suspect unless some more brightness can be obtained. The overall performance of the unit is very similar to IBM's own colour unit; excellent for graphics, but rather coarse for constant use on text. For word-processing applications the monochrome unit is probably preferable. Graphics screens are clear and stable, and show good colour balance.

Switch on the Canon, and apart from the lack of a ROM Basic to default to, it is hard to distinguish it from the IBM PC. The fan is reasonably quiet and the disc drives emit only gentle grunts when reading or writing. It turns in a significantly better performance when running the Basic Benchmarks, as befits its 8086 chip. Disc performance, on the other hand, indicates that the Canon disc drives are marginally slower than those fitted to the IBM.

The A-200 comes with an absolutely standard version of MS-DOS version 2.11. Microsoft's Basic interpreter is included as

(continued on page 77)



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Faster throughput comes from the 3404 with 400cps in draft mode and 100cps for near letter quality. There's also an impressive graphics capability as well as a colour printing option. Add an automatic sheet feeder and the printer can be left to work on its own!

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● Circle No. 153

(continued from page 75)

standard and is called up off the system disc as Basica. When loaded, Basica leaves approximately 61K of memory for user programs. A second disc supplied with the machine contains comprehensive diagnostics routines which will enable any errors to be logged on to a data disc.

Canon takes the bold step of guaranteeing IBM software compatibility, though users may have a hard job taking them to task on this claim. The machine ran everything that was thrown at it without any undesirable side effects. We tested packages ranging from state-of-the-art software like WordStar 2000, dBase III and Smart through to old favourites like Multimate, Open Access and Lotus 1-2-3. Even desk-top aids like Sidekick that lurk in the lower areas of RAM beneath the major package ran without any problems.

At present there is no integral hard-disc option within the A-200 range. A 10Mbyte version is planned for June, and Canon offers add-on units with capacities from 10Mbyte to 114Mbyte. The 10Mbyte unit costs £1,495.

The A-200 is supplied with three A5 ring-bound manuals, each enclosed in a cardboard case. The Users' Manual is written in an informal way but still manages to cover most of the points a first-time user will need to know. Quite a large portion of the manual is actually taken up showing flow charts for use with the advanced diagnostics disc to help in fault finding. The final chapter describes how to get inside the machine, fit expansion boards and reset the DIL switches.

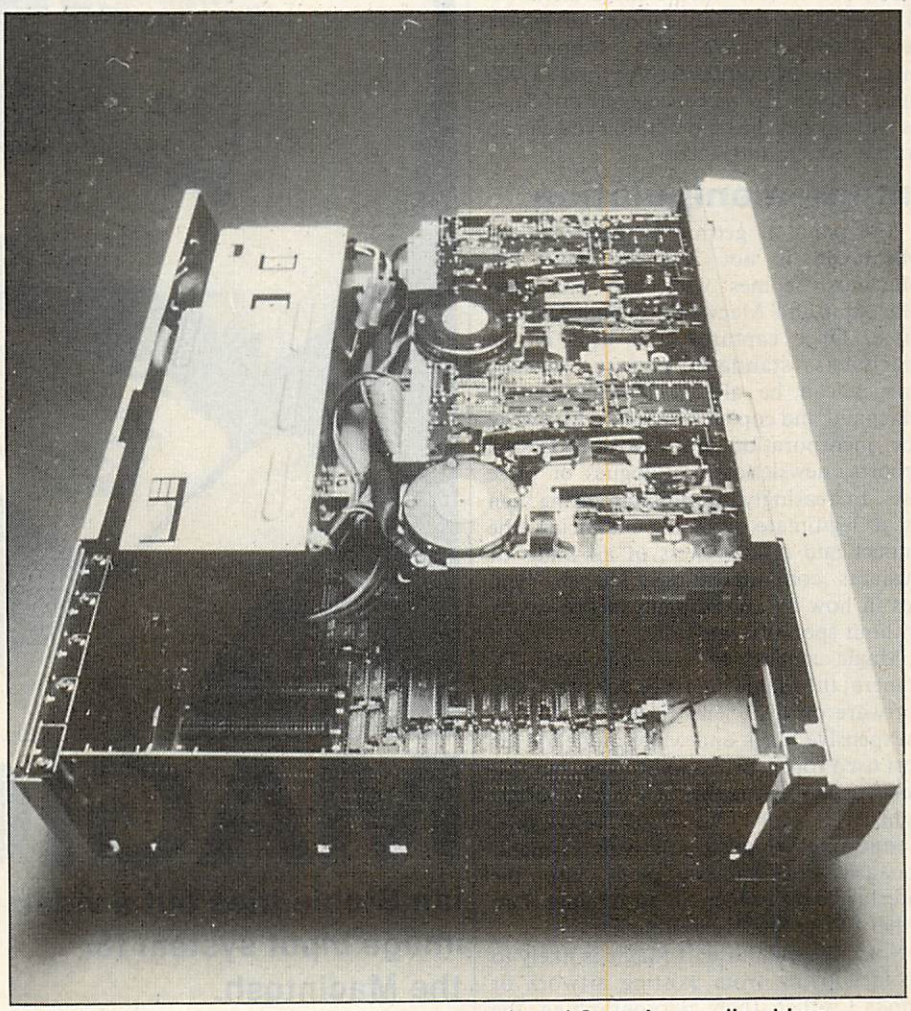
The comprehensive DOS Users' Manual covers most of the facilities available from within MS-DOS, even some of the more complex ones like Debug and Unassemble. The Basic Users' Manual uses the standard Microsoft-style presentation, with the addition of some useful preliminary information.

Considering the reliability of most of Canon's other products the 90-day return-to-depot warranty seems a trifle on the mean side, though we understand it is under review. A one-year minimum should not be too much to hope for these days. Canon intends to expand its existing office-equipment dealer network to sell the A-200, and will support the hardware through maintenance agreements with Vistec-TSS; although schemes and rates have yet to be finalised.

Basic Benchmarks

The table shows the time in seconds to run the standard Basic routines — see *Practical Computing*, January 1984, page 102. The Canon A-200 has the same CPU as the Olivetti M-24 but runs at the same clock speed as the IBM PC; not surprisingly its performance lies mid-way between the two.

	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8	Av.
Canon A-200 — 8086	0.9	3.4	7.4	7.6	8.3	14.8	23.5	25.6	11.4
Olivetti M-24 — 8086	0.5	2.0	4.6	4.7	5.2	9.4	14.8	16.1	7.2
IBM PC — 8088	1.2	4.8	11.7	12.2	13.4	23.3	37.4	30.0	16.8



A look inside reveals a well-shielded power supply and Canon's own disc drives.

Conclusions

- **The A-200 is typical of many Japanese products: a rather tired idea bolstered by impeccable presentation.**
- **The use of an 8086 processor and partial 16-bit expansion bus make the A-200 appreciably faster than an IBM PC, but it is a shame that the clock speed remains at 4.77MHz.**
- **Compatibility is superb, and certainly puts the Canon up among the class leaders.**
- **The high-quality construction augers well for long-term reliability.**
- **At £1,875 for the 256K monochrome version, pricing is very competitive for a true 16-bit 8086-based machine.** PC

Bagshaw Benchmarks

The table shows the time in seconds to run 14 Benchmarks designed by Eric Bagshaw of the National Computing Centre to show the speed of disc accesses — see *Personal Computer World*, November 1984, page 180. The three machines were all tested using the standard 320/360K 5.25in. discs fitted.

	BM0	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8	BM9	BM10	BM11	BM12	BM13	Total
Canon A-200	20	17	16	23	28	50	12	76	18	8	15	326	162	61	832
IBM PC	21	10	21	21	20	30	8	65	17	7	15	311	145	51	742
Compaq	24	11	16	24	24	36	8	67	16	7	13	319	125	49	739

MAGIC

Ian Stobie tries out a video-image input system for the Macintosh.

TO GET the best from packages like Macpaint and Macwrite some way of de-skilling the task of getting pictures into the computer is needed. The highly visual approach to computing embodied in Apple's Macintosh machine is all very well, but not everybody can draw. The most obvious answer is a camera input system,

The first product to be widely available in the U.K. is called Magic, and costs £695 plus VAT with a video camera included. By the time of publication we expect several rivals to have appeared ranging in price from around £250 to beyond £1,000 but in this review we concentrate on Magic as it illustrates the kind of thing you can do with a camera interface.

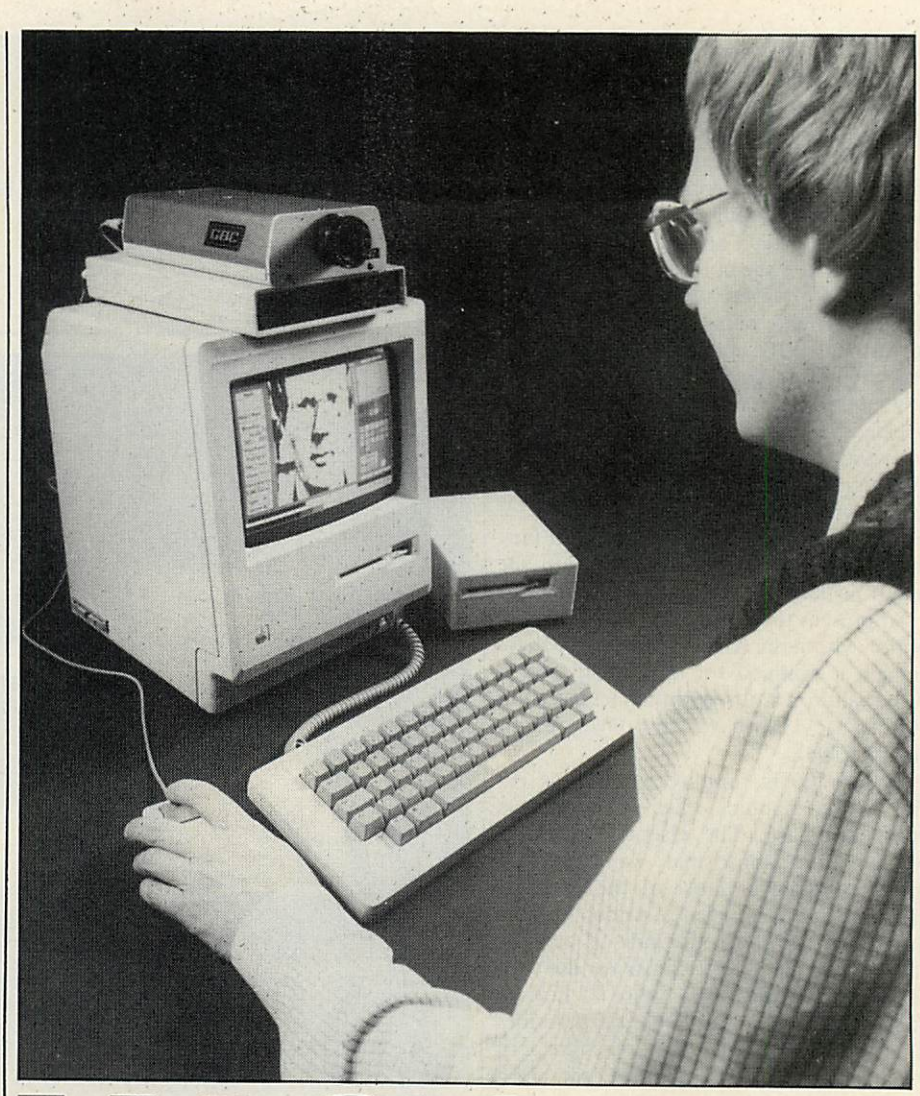
Image manipulation

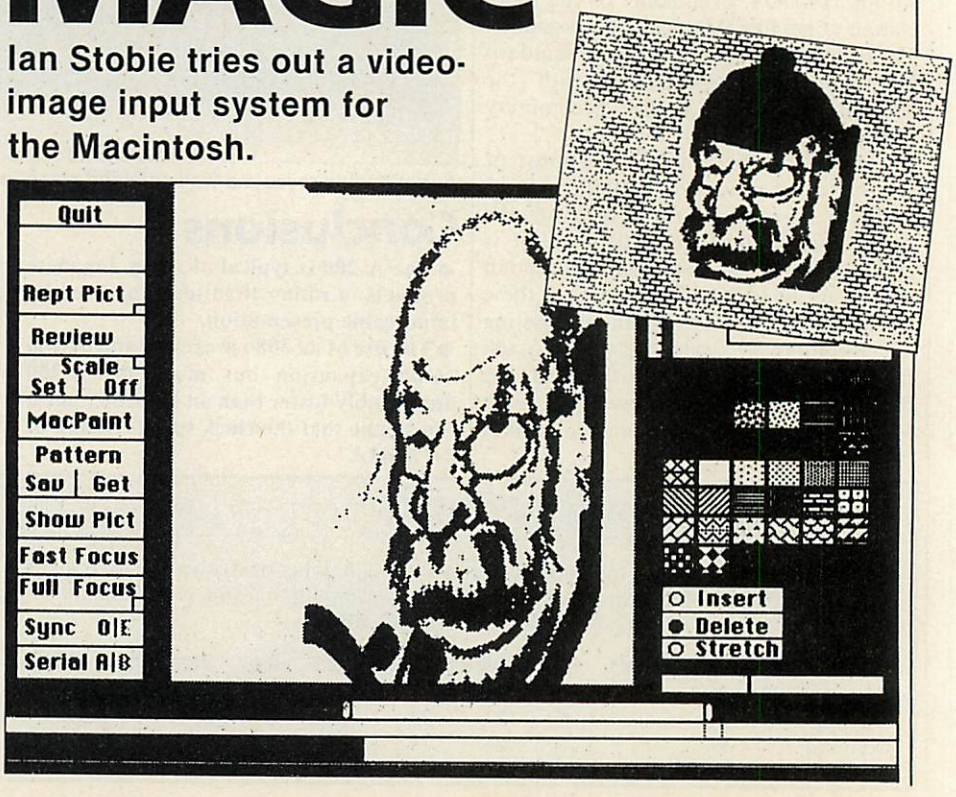
The point of getting pictures into the Macintosh is not just be arty. The Macintosh comes with two packages, Macpaint and Macwrite, included in the price. Once captured and held in the machine's standard picture format, images can be altered if necessary in Macpaint and copied across into Macwrite for incorporation into word-processed reports, newsletters, catalogues or price lists. Increasingly, graphics are being seen as a legitimate way of enhancing the impact and effectiveness of all kinds of business communication. The problem lies in how to use graphics inexpensively without specialist staff.

Magic consists of a closed-circuit TV camera, the Magic interface box itself, and software on disc. The camera is a fairly inexpensive black and white model of the sort used for security monitoring, but this does mean it is capable of working at low light levels and that it should be reliable. Connecting it up is relatively straightforward; the camera plugs into the interface box, which in turn plugs into either of the Mac's serial ports.

Since the main use of Magic is likely to be in copying from existing artwork or books, rather than photographing the landscape, you probably need to obtain a tripod or copying stand, and possibly some lights. We used two Anglepoise lamps equipped with 75 watt photographic bulbs, but found that for us bright daylight generally produced the best results. If you are doing a lot of copying it is also worth trying a different camera lens to the one provided; you can fit a wide range of C mount lenses, available from photographic stores, to the Magic camera. We found copying different size documents much easier with a 12.5-70mm. zoom lens.

Once everything is connected you put the disc into the Mac and click on the Magic icon. What you then see is the





The control screen, with the lower pattern bar set to reproduce an illustration in black, white and one intermediate grey tone. Once captured, the image can be altered using Macpaint (inset).

Other products

At £425, Micron Eye is at the cheaper end of the range, and it is has just become available. Differences in price generally relate directly to differences in speed and performance. Micron Eye's price includes a simple camera-like device built from 256K dynamic RAMs with quartz lids. Light falling on the RAMs affects the refresh time so they can be used as the basis of a low-cost camera. Resolution is limited to 256 by 256, and top speed for capturing an image the size of Macpaint's window is about 5 seconds.

Koala's Macvision, at an expected price of around £450, not including a camera, is a more comparable product to Magic. It has good software, the ability to interface to a range of standard cameras and a speed quoted at around 5 seconds for a typical Macpaint-size screen. P&P has not decided a price for Private Eye, but this will be at the top of the range as it can capture an image in 1/25th of a second. This is the sort of speed you need to capture a broadcast or video image because even when using a video-cassette recorder on freeze-frame the image is not stable, and results are poor with the slower input systems.

Probably the most interesting product announced so far is Thunderscan. It has no camera; instead you replace the ribbon cartridge of your Imagewriter printer with a device which scans artwork placed in the printer line by line. Obviously this approach is only able to copy images already held on paper. Thunderscan is cheap at £249, though until we have seen one we cannot say whether it is any good.

More details of all these products are available from P&P Micro Distributors Ltd. Telephone: (0706) 217744.

Magic control screen with the image you are currently photographing or working on in the middle.

The Magic software does not observe the usual Macintosh conventions, and we did not find it particularly easy to get the hang of. You do control the system most of the time with the mouse, but there are no pull-down menus, and mouse-clicking conventions vary from the Mac norm. The manual was poor, but we had a provisional version and Heyden promises a full rewrite. After a while the system is not difficult to use, but we felt the user interface could have been made simpler for occasional or first-time use.

The key controls are the two gradated bars at the bottom of the screen, the pattern and cut bars. Magic can capture both simple black and white images, or more complex ones made up from different patterns or graduated grey tones. The cut bar is used to control the brightness of a black and white picture, having much the same effect as an aperture control. You slide the black area to the right or left in the cut bar to adjust the exposure.

Specification

Price: £695 plus VAT, includes camera, 16mm. lens, interface box and software disc
Interface box: accepts camera or VCR input; outputs to either Macintosh serial port and to optional video monitor
System requirements: 128K or 512K Macintosh
Manufacturer: New Image Technology Inc., U.S.A.
U.K. distribution: Heyden Datasystems, Spectrum House, Hillview Gardens, London NW4 2JQ. Tel: 01-203 5171

The pattern bar is used to assign patterns to different brightness levels. Like the cut bar, the left side of the bar represents the darkest parts of the image, the right side of the brightest. You use the mouse to drop, say, a stipple pattern into the pattern bar at the intermediate dark level. You can use up to 38 different patterns in any one picture, and you can also load completely different patterns from disc. The patterns used are in the same format as Macpaint uses, so you can create your own patterns with Macpaint too. The Magic disc comes with several sets of patterns on it.

As you become familiar with Magic you find that the two bars allow a powerful degree of control over the final image. Patterns do not have to be in order, so you can have a dark pattern representing the lightest part of the image for example, which in effect superimposes the image on a dark background, or you can very easily create a negative image. The cut bar can also be used to isolate a particular tonal range in the image, and you can then move a pattern for the brightness level thus identified into the pattern bar. In general, when creating pattern images you tend to use the cut bar to focus the camera and preview the exposure, and use the pattern bar to control detailed effects.

The control screen normally shows a window into the image, but Magic also lets you take a full-screen image by clicking on the appropriate control box at the left of the screen. A full-screen image consisting of 512 by 342 dots takes a little longer to capture: 0.36 seconds in black and white against 0.2 seconds for just the window. Patterned pictures always take longer because they are built up pattern by pattern with the scan for each pattern taking 0.7 seconds.

The Magic software has a couple of good features it would be nice to have in Macpaint. Review lets you read in an image stored on disc a good deal quicker than the equivalent Macpaint operation, taking just under two seconds. Since it works with any Macpaint file, not just ones created with Magic, it is very useful for scanning through your existing picture library. Scale lets you redimension any Macpaint image. Again it is better than the Macpaint facility and provides a convenient way to redimension large Macpaint pictures, which is otherwise incredibly difficult.

Print problems

Having captured an image, at some stage you will want to print it. The version of Magic we had did not allow you to do this directly; we had to exit and print from Macpaint. The Magic manual excuses this by blaming Apple for not giving Magic's manufacturer, New Image Technology, the necessary information to duplicate the printing algorithm used in Macpaint, but at some stage it will have finished writing its own code to enable it to do so.

We had no difficulty at all copying Magic into both Macpaint and Macwrite. Since many other packages use the same picture format this established the principle that Magic images once captured can be fully used.

All the output examples reproduced in this article were produced with the Apple Imagewriter printer. Apple's expensive laser printer does not yet have the capacity to print Macpaint documents, and hence Magic images. When it does it should improve the image quality considerably.

Conclusions

- **Magic is a useful product because it provides a way for the non-artist to get graphics into the Macintosh. It is about as cheap a system as you can get without making an appreciable sacrifice in resolution or speed.**
- **Magic is not simply a frivolous product as many sensible Macintosh business packages can put graphic images to good use. Catalogues, reports, newsletters and artwork roughs are among the obvious practical applications.**
- **We found that good, even lighting made a great improvement to the results we obtained, so most commerical users would probably also want to get hold of a copying stand and some lights. The camera lens fitted is adequate for most tasks, but a zoom lens would make it easier to copy different size documents.**
- **The Magic user interface could have been better thought out, and the documentation definitely needs the promised rewrite. Once you have spent some time familiarising yourself with it, Magic is easy to use. We are confident that good results are possible with the system once you are used to it.** PC

OKIMATE 20

Refined thermal-transfer technology is the key to the high-quality full-colour output of this neat, cheap unit. Ian Stobie investigates what looks like an ideal printer for presentation graphics.

A CHEAP PRINTER rather surprisingly turned out to be the most interesting product at the recent IBM PC Trade Show. Costing only £259 plus VAT, the Okimate 20 can produce screen dumps in deep saturated colours on both paper and overhead-projector transparency film. It uses a thermal-transfer printing technique, a technology which looks increasingly like developing the potential to oust impact matrix printing from its dominant position at the cheaper end of the printer market.

The unit we got for review was the IBM PC version of the Okimate. An Apple IIe version will be available soon, to be followed possibly by a BBC version in the U.K. Standard Centronics parallel and RS-232 serial versions are already on sale alongside the IBM model, but these do not have the same capacity to dump full-screen graphics as the customised versions. The price is the same for all the models.

The Okimate 20 is very compact, occupying a desk-top footprint of 13in. by 7.5in., although it takes standard size A4 and fanfold paper and prints across 80 columns in its normal type size. The print-head mechanism itself is tiny, and the key to the low cost.

No moving parts

Instead of the conventional matrix printer's array of needles moved by solenoids, the Okimate print head is made up of a row of tiny heating elements. They press against a ribbon coated with a wax-based ink, and actually melt the dye on to the paper beneath. This technique is quiet and does not require special paper — just special ribbon, which is more cost effective. There are no moving parts in the head so there is less to go wrong mechanically.

Since you can cram more tiny heaters into a given space than print needles it is much easier to achieve higher-resolution printing. The Okimate has 24 heating elements, compared to the nine needles of a typical dot-matrix printer; this allows it to form characters on a matrix of 14 by 18 dots in its best-quality text mode, or print graphics at 144 dots per inch.

Earlier thermal-transfer printers had much the same potential, but were let down by the other crucial ingredient in the technology, the ribbon. Close examination of their printed output reveals a high-resolution image with bits missing around the edges. This does not seem to be a problem with the Okimate system, and colour transfers from the Okimate's waxed-based ribbon to the paper quite satisfactorily at the temperatures achieved by the print head.

Coloured segments

The Okimate's colour ribbon is unusual in that it is made up of alternating coloured segments. Most impact dot-matrix colour printers, such as the Epson JX-80, have colour ribbons with horizontal stripes and work like a typewriter, moving the whole ribbon up to engage the correct colour. The Okimate's ribbon has about eight inches of pure blue, the same length of pure magenta and then of yellow, and finally a short clear gap followed by a black reference marker before the sequence begins again. The printer is quite intelligent, winding on to the ribbon colour it requires.

The three colours chosen are the same as those used in colour printing, and are capable of producing a wide range of hues when used together. Apart from simply overprinting solid colours, which gives you seven different colours, you can produce many more shades by overprinting chequered patterns that combine colour with white space. The excellent manual documents 26 different colours which are easily accessible from Basic. The screen-dump software in the IBM version of the Okimate seems capable of a good deal more; different Oki handouts claim variously between 50 and 100 shades.

To produce IBM colour screen dumps involves no programming. You run the Okimate installation program, which comes on disc, and that's it: you can then dump whatever appears on the screen simply by hitting Shift and the Print Screen key. We did initially have a problem with white stripes across the paper, which made all our dumps look like Venetian blinds, but this was cured by going back into the installation program and changing the line advance value to its only other permitted setting. Compared to most printers we found the Oki very easy to set up and get working properly.

One big advantage of thermal-transfer printing is that you do not have to use special thermal coated papers. However, print quality is far better on the shinier papers. Our A4 letterhead and standard listing paper gave a readable result, but it was inferior to the average impact dot-matrix. The Okimate is fitted with both an adjustable tractor feed and friction feed, so you can try out a variety of different shingle-sheet and continuous stationery.

Where the Okimate really scores is in its ability to print on the acetate film used on overhead projectors. Getting acetates produced professionally is expensive and involves delay, but the Okimate used with virtually any IBM PC graphics package gives you the capacity to produce perfectly good results in-house. The Okimate is in fact at its best on acetate as it likes the shiny surface; unlike an ink-jet printer or plotter the output does not smudge. However, the thicker art-quality acetate will not fit between the friction-feed rollers, so you are better off with cheaper film.

There are a few other drawbacks to this generally good machine. It is undoubtedly slower at printing text than the typical Epson RX-80 and FX-80 type of impact matrix printer, and things slow down considerably when you are colour printing. Using a black ribbon text is printed at a claimed 80cps in draft mode, with characters formed on a 7- by 18-character matrix. In the higher-quality 14 by 18 correspondence mode the speed drops to 40cps.

In practice the Okimate is slower than the raw cps figures suggest, as it prints in

Specification

Printing method: thermal-transfer dot matrix
Print head: 24-element thermal
Character matrix: 7 x 18 in draft mode, 14 x 18 in correspondence mode, 144 dots per inch in graphics mode
Speed: 80cps in draft mode, 40cps in correspondence mode, two vertical inches per minute in full-colour graphics mode
Print features: normal, italic, underline, subscript and superscript; six character sizes printing 5, 6, 8.5, 10, 12 and 17 characters per inch; dot-addressable graphics
Paper feed: adjustable tractor feed for fanfold paper up to 10in. wide, friction feed for single-sheet A4
Size: 330mm. (13in.) x 190mm. (7.5in.)
Availability: standard parallel, standard RS-232 serial, and IBM PC model with graphics software available now
Price: £259 plus VAT
Manufacturer: Oki Electric Industry Co., Japan
U.K. distribution: X-Data Ltd, 750-751 Deal Avenue, Slough Trading Estate, Slough, Berkshire SL1 4SH. Telephone: (0753) 72331

Above: The Okimate produces exceptionally bright and clear colours. Top right: The colour ribbon is divided into sections of yellow, magenta and cyan. Below: The thermal print head contains 24 heating elements which melt the dye on to the paper.

How Okimate Mixes Color
OKIMATE uses a 3-color ribbon. It can create more than 100 shades by mixing colors like a painter.
Let OKIMATE show you how.
Print Color Demo?
Y = Yes
N = No
(Use color ribbon)

one direction only, which helps it preserve better registration accuracy. Colour printing is slower still, as three passes may be necessary for each line to build up the required shade. A full-colour screen dump takes about 10 minutes. We noticed a slight difference in speed between the different IBM clones we tried the system out with, so the printer is not the only factor involved.

Nevertheless, we don't see speed as a major consideration. Compared to a daisywheel the Okimate is quick, and plenty of people still buy these when presentation quality matters to them. Most potential Okimate 20 purchasers probably already have an Epson matrix printer or IBM's variant. We would not recommend the Okimate as the only printer for a business user; it is probably best kept just for colour work.

Running costs also matter with any printer. Oki quotes a life of about 15 full-screen dumps for the colour ribbon, which seems an honest figure by our reckoning. The black ribbon should last about four or five times as long. No one could give us a definite price yet for the ribbons, but around £6 or £7 is the expected price for the colour ribbon.

Conclusions

- **At £259 the Okimate is a staggeringly good buy for anyone interested in producing colour graphics on paper or overhead-projector transparences.**
- **Compared to competing colour printers, which generally use impact-matrix or ink-jet technology, the Okimate produces much more strongly coloured and satisfactory images.**
- **For monochrome text printing the Okimate gives very acceptable correspondence-quality output: it is better than most matrix printers but inferior to a daisywheel.**
- **Monochrome printing speed again lies between these two types of printer. Colour printing is slow, but well worth waiting for given the image quality that you end up with.**
- **Although you can get some kind of image on almost any paper, the Okimate clearly works best with smooth-surfaced paper and thinner types of overhead-projector acetate film.**
- **With more and more serious packages using colour graphics the Okimate 20 looks like the product the business micro world has been waiting for.** PC

TANDY 1000

Following last month's assessment of the hardware, Jack Schofield now takes a closer look at the Deskmate program supplied with the machine.

THE TANDY 1000 is a low-cost IBM PC compatible colour computer designed to have universal appeal, both in the hardware, which was discussed in detail last month, and the bundled software package, Deskmate.

Deskmate is a one-disc integrated software package which includes a word processor, spreadsheet, filing program, comms program and appointments calendar with built-in alarm. There is also a simple calculator which can be brought into use at any time.

The main user-friendly features are: the opening screen display, which makes it possible to run sub-programs just by positioning the cursor over them and hitting Enter; the use of function keys for most commands; the consistent command structure; and the fact that on-line help is always available.

MS-DOS separate

The disc includes all the software plus some sample material used with the excellent tutorial manual supplied. It does not include MS-DOS, which is supplied on a separate disc. However, if you have not created any files you can install DOS on a work disc with a copy of Deskmate, which means only one disc is required to boot the system. However, if you have created files there is not enough room for DOS as well.

When you first boot Deskmate it comes up in monochrome, but you can use Control and the first four function keys to set the colours of your choice. Your selection is then preserved with the disc. Although the colour aspect may seem trivial, in use it is one of the nicest parts of the system.

The opening screen is divided into two parts. At the very top the screen tells you the date and time — information which you have previously typed into MS-DOS. Underneath there are two boxes containing a calendar and, next to it, a box called Events for Today. Any appointments in your Calendar file are extracted by the system and automatically displayed on the appropriate date.

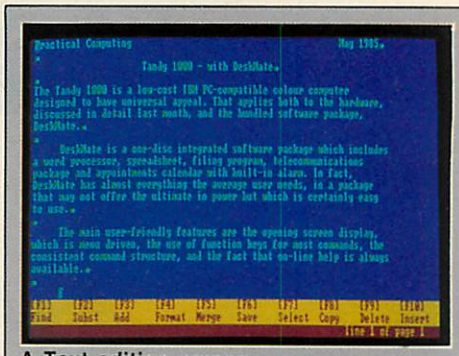
The lower part of the screen mainly comprises six boxes, each labelled with the appropriate function from Text and Worksheet to Mail. Each box contains an alphabetical list of the files already created by those sub-programs, so all text files are listed in the Text box. Although there is only room to display 11 file names, the list scrolls so that the practical limit is the number of files which can be held on a single disc along with program files.

Function keys

At the very bottom of the screen are the assignments for the function keys, which run conveniently along the top on the keyboard. Each key has two functions. The primary function, which is unshifted, is the one that applies to the specific sub-program in use. The secondary functions, which are always the same, are accessed by pressing the Alt key along with the function key. Until you learn what the Alt functions do — that is, Help, Calc, Alarm, Phone, Printer, etc. — you can use f11 to view the labels.

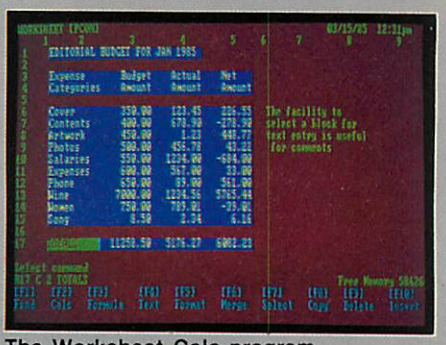
The mention of f11 should give pause for thought. The Tandy 1000 is an IBM PC compatible micro, yet the IBM PC only has 10 function keys. The Tandy 1000 has 12, with f12 being in constant use as a Do or Execute key to exit from sub-programs and save files automatically. On test, the Tandy was found to run IBM PC discs of monochrome and colour programs, providing that the IBM monochrome screen/printer adaptor was not required.

However, Deskmate makes extensive use of the two extra function keys, f11 and f12, which appear to have no meaning as far as the IBM keyboard is concerned. While Deskmate will load into an IBM PC, without f11 and f12 it is impossible to do anything useful with it. At any rate, this explains why Tandy is unconcerned about giving away an unprotected disc of a program worth perhaps a couple of hundred pounds with each machine. Unless you already have a Tandy 1000 it is probably of no use to you.

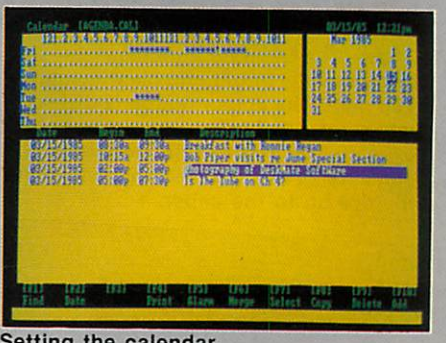


A Text editing screen

A record from Filer.



The Worksheet Calc program.



Setting the calendar.

Deskmate provides six main applications which, apart from business graphics, perform most of the functions that most users need.

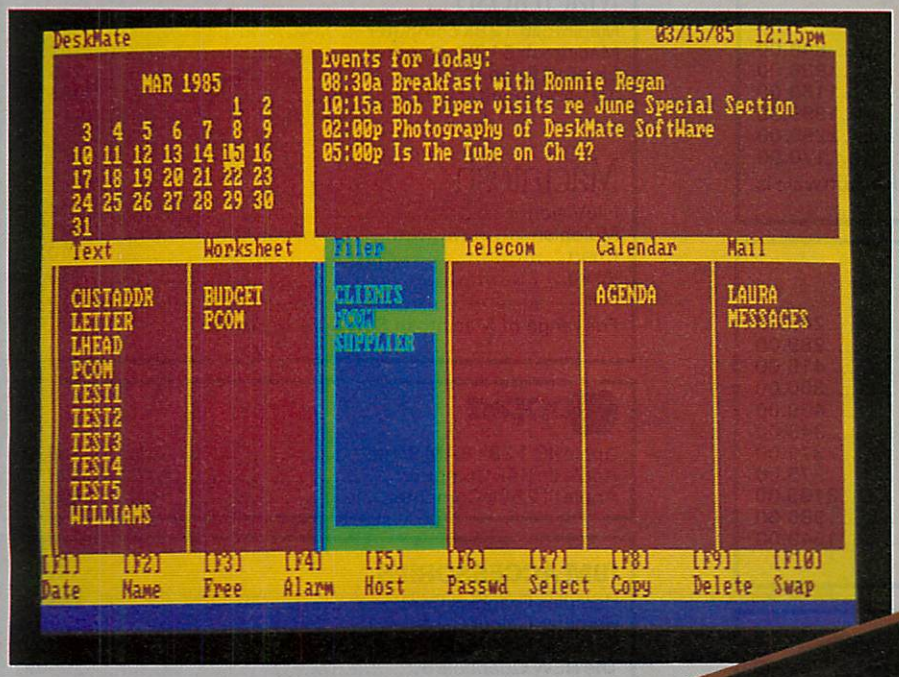
Text is the word processor. It displays 22 lines by 79 characters in the colours of your choice, and offers a reasonable degree of functionality considering how easy it is to use. Normally it is used in Insert mode. However, f3 toggles between Add and Replace, with the latter providing an Overwrite mode.

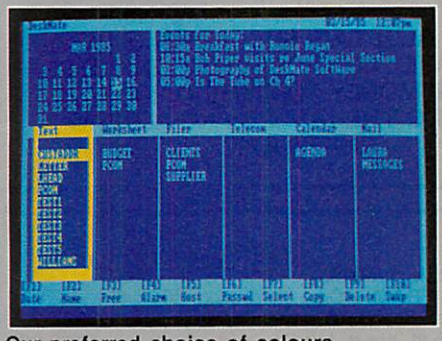
It is worth describing the other function keys at length because many of the same assignments are used in other sub-

Basic Benchmarks

The standard Benchmarks were run with GWBasic running under MS-DOS v.2.11 on the Tandy 1000. All times are in seconds.

	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8	Av.
Tandy 1000 — 8088	1.4	5.4	11.9	12.3	13.6	25.0	39.0	39.3	18.5
IBM PC — 8088	1.3	4.8	11.8	12.2	13.4	23.6	37.6	36.6	17.7
Olivetti M-24 — 8086	0.5	2.0	4.6	4.7	5.2	9.4	14.8	16.1	7.2





Our preferred choice of colours.

programs. It also illustrates the strong resemblance to another popular suite of software. The other function keys work as follows.

f1 or Find searches for a string.

f2 or Substitute provides Search and Replace but not as a global function.

f4 or Format enables you to change the line width displayed up to the screen maximum.

f5 or Merge enables you to combine documents in memory.

f6 or Save allows you to save a copy of a text on to drive A or B without exiting the word processor.

f7 or Select allows you to highlight a piece of text and either move it or delete it.

f8 or Copy makes a duplicate of any text selected with f7 and puts it in a buffer, which enables it to be moved to somewhere else. Copy does not delete.

f9 or Delete enables you to delete any text selected with f7.

f10 or Insert brings back the contents of the copy buffer.

Deskmate's Text works in exactly the same way as text in the Tandy 100, NEC 8201a and Olivetti M-10. Even the choice of function key is the same where possible. Deskmate is the exact equivalent of this kind of lap-computer software.

What Text lacks are the more sophisticated functions such as line centring, headers and footers, and decimal tabs. Though all these can be done manually, obviously Text is not a competitor for serious programs like WordStar.

(continued on page 85)

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Bagshaw Benchmarks

The table shows the time in seconds to run 14 Benchmarks designed by Eric Bagshaw at the National Computing Centre to show the speed of disc accesses — see *Personal Computer World*, November 1984 page 180.

	BM0	BM1	BM2	BM3	BM4	BM5	BM6	BM7	BM8	BM9	BM10	BM11	BM12	BM13	Total
Tandy 1000	29	16	16	38	18	48	14	75	21	9	14	305	156	55	814
IBM PC	21	10	21	21	20	30	8	65	17	7	15	311	145	51	742
Canon A-2000	20	17	16	23	28	50	12	76	18	8	15	326	162	61	832

(continued from page 83)

One further and major limitation is that the size of document is limited by the amount of available RAM. To construct a long document you must tediously string files together and use the appropriate function keys to cut and paste and so move blocks from file to file.

The spreadsheet sub-program, Worksheet, offers 99 rows by 99 columns. The design is reminiscent of Microsoft's Multiplan, especially the ROM-based version for the Olivetti M-10. The function keys are similar to those in Text and seven out of 12 are identical, including f1 or Find.

Worksheet is set up without automatic calculation, so after changing a few figures you have to hit f2 or Calc to recalculate everything. If it did not work in this way it would be too slow to be usable.

Unrestricted text

Ultimately Worksheet is a lot less powerful than Multiplan, but it does have one neat feature. You can use f7 or Select to highlight a group of cells and then specify it as text. This enables you to type labels and comments without worrying about the limited size of actual cells.

The Filer sub-program is an unpretentious flat-file system that is essentially an extension of the Text word processor. You start by pressing f5 or Form to create a form with up to 21 fields. Each line has space for a label of up to 15 characters, and a field of up to 59 characters. A label can apply to more than one field line, so a field can be up to 255 characters in length, which is about 4.3 lines.

Again, several of the function keys have the same functions as in Text, and f1 or Find can be used to find a text string in any field in any record. This is very useful as it allows for card-index type searches on free-form text, which must appeal to the non-computerate.

Records can also be searched on selected fields for entries that are greater than, equal to or less than the search criterion. Any records found can be examined one at a time or listed separately. Filer is exceptionally easy to use, and provides a powerful way of handling casual records.

Telecom is the communication sub-program. It allows you to set up parameters easily and, in theory, can drive an auto-dial and auto-answer modem. Auto-answer can be used with the Tandy 1000 in Host mode, so you can call your computer up from outside. Naturally password protection is provided.

While the software looks easy to use, the Tandy 1000 lacks an RS-232C port, so it was not possible to hook up a standard modem and try it out. An RS-232 board costs £89 extra.

Calendar is an event scheduler with three main elements. It provides an ordinary calendar for the month, a weekly time chart and an appointments list. The idea is that you enter your appointments into a list, giving the date, plus the start and end times. Calendar sorts them into chronological order, and fills in the time chart so that you are alerted if appointments overlap. When you boot the system, Deskmate checks the Calendar file and produces notes to remind you of any appointments on that particular day. If the alarm is set, it will then alert you at the specified time with four short, quiet beeps.

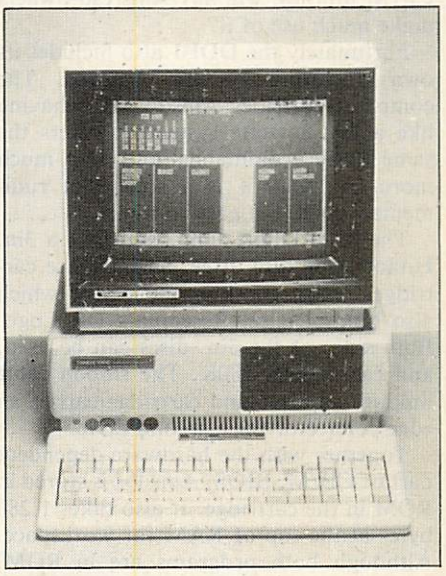
Calendar is one of those programs that sounds good but in practice is unlikely to replace a boring old desk diary. It is too time-consuming to make it worth using.

Mail is a simple message handler, which is actually an extension of Text except that it fills in the date and time you create a message, then files a record. It also collects incoming messages with the Tandy 1000 in Host mode.

Possibly Mail is useful if you have a modem and either a lap portable — so you can send messages to yourself — or a mailbox on Telecom Gold. Without these there does not seem to be any use for it.

None of the Deskmate sub-programs is very sophisticated. However, they are friendly and the whole package is easy to use. This makes it suitable for the executive for the school/home/business user who needs to tackle a range of tasks without going too deeply into any one in particular. It also makes Deskmate ideal for beginners. Anyone who becomes familiar with the package will be in a very good position to choose among the many specialised packages available.

Overall, the Tandy 1000 is quite good value. A system with keyboard and colour monitor, 128K of RAM, two 360K floppy-disc drives, MS-DOS, printer port and games port would cost £1,867 plus VAT, compared with an IBM PC of equivalent specification at £2,655 plus VAT. With the Tandy you lose the monochrome character set, but you do get Deskmate as an extra attraction. Whether this is worthwhile depends on the application.



Conclusions

● The Tandy 1000 is sufficiently IBM compatible to be acceptable as a substitute for an IBM PC, and significantly cheaper considering the facilities provided.

● IBM compatibility is potentially limited by the fact that the Tandy 1000 keyboard is different and the case will not accept IBM expansion cards that are longer than 10in.

● The provision of colour as standard, plus printer, light-pen and joystick ports, makes the Tandy a universal machine for home and educational use, as well as for the business executive.

● The Tandy 1000 does not emulate the high-resolution monochrome screen of the IBM PC. The relatively poor resolution of the colour character set makes it unsuitable for use as workhorse for word processing, filing, spreadsheets or accounting use.

● Deskmate is an attractive multi-function package which is easy to learn and use. It is particularly suitable for tackling simple tasks on a machine with only one disc drive. It is not powerful enough to replace stand-alone packages for serious business use.

● Ready availability in Tandy's High Street computer shops should ensure a wide market for the Tandy 1000 and expand the market for IBM PC compatible software.

● The Tandy 1000 without monitor costs £1,099 plus VAT from Tandy, Tameway Tower, Bridge Street, Walsall, West Midlands. Telephone: (0922) 648181. PC

Amstrad disc software

There have been high hopes that discs and CP/M would lift the CPC-464 into the "serious" category. Simon Beesley has been finding out whether it now bridges the gulf between home and work machines.

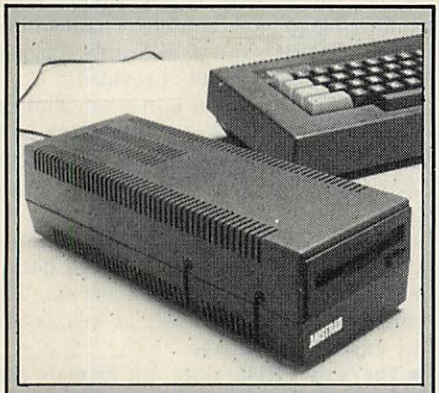
FOR TODAY'S computer users the initials CP/M no longer have the same resonance they did, say, six years ago. Probably most will have noticed that it is almost obligatory to refer to the "wealth of applications software" available for the system. These considerations are prompted by Amstrad's decision to provide CP/M 2.2 with its DDI-1 system. Apart from dusting down some ancient CP/M utilities, will any Amstrad owners make much use of it?

Fortunately the DDI-1 also includes its own operating system, Amsdos. The company describes Amsdos as behaving like a fast cassette system: it offers the same Basic commands and not much more. As such it is a somewhat rudimentary DOS but easy to use.

The £199 DDI-1 unit comprises a 3in. Hitachi-type disc drive, an interface cartridge, and a CP/M system disc which also holds Digital Research's DR Logo. Both sides of the 3in. discs can be used, and each stores 180K. The ribbon cable linking the drive and cartridge carries an edge connector for a second drive.

Together with the hardware-dependent part of CP/M, BIOS, Amsdos is stored in ROM in the cartridge. It also takes 1,280 bytes at the top of RAM for workspace. Although both programs are in ROM, hackers will be able to tinker with them by intercepting their jumpblocks in RAM.

Although Amsdos is not spectacularly fast it compares well with other home-computer disc systems. Reading 1,000 records takes around 12 seconds, writing them a second longer. On the BBC Micro with an Acorn drive the same program takes 21 seconds. Using a Control Data drive with Acorn's disc filing system reduces that figure to 14 seconds.



The £199 DDI-1 disc drive unit takes durable Hitachi 3in. discs.

Suppliers

AMSTRAD CONSUMER ELECTRONICS, 169 Kings Road, Brentwood, Essex CM14 4EF.

DDI-1 disc drive unit with CP/M and DR Logo, £199; additional drive, £159
Microscript, Micropen and Microspread, £49 each
Firmware guide, £9.95

TIMATIC SYSTEMS, Newgate Lane, Fareham, Hampshire PO14 1AN.

5.25in. disc drive, with utility software, for use as second drive, £169
extensive range of CP/M software supplied in Amstrad format

All prices include VAT

As well as the Basic file-handling commands, Amsdos provides some Basic extensions, which are preceded by the bar character. |Disc, |Tape and |CPM switch between the tape filing system and the two systems; |Dir displays the directory and accepts the * wild-card character; |A and |B select one of the two possible drives. Commands such as |Disc.In and |Tape.Out are useful for transferring from tape to disc.

Otherwise there is not much scope for more sophisticated file handling. |Era and |Ren erase and rename files, but in practice they are cumbersome to use. There is no provision for setting up random-access files.

Disc formatting

However, to some extent the two operating systems are compatible, and some of the utilities on the CP/M system can be used with programs stored under Amsdos. Thus CP/M will not understand Amsdos Basic programs unless they are saved in ASCII format, but Pip will copy any files between two discs. In addition, Amstrad has tailored familiar CP/M utilities like Sysgen to this version of the system, and has included a set of new programs such as Filecopy and ChkDisc.

The user also needs to switch to CP/M to format a disc. Three different formats are supported. In each the disc is divided into 40 tracks with nine sectors of 512 bytes, and allows for 64 directory entries. The standard Format command allocates the first two tracks to CP/M. Format D frees these tracks for discs which will only be used by Amsdos files; the third option gives discs the same format as used on IBM PC discs under CP/M-86. In the DDI-1 manual IBM format is said to be intended for specialist use, but it is clear that its main purpose is to facilitate the transfer of CP/M software.

On the CP/M side the DDI-1's manual is rather sketchy. To supplement it Amstrad is releasing additional documentation in the form of a guide to the firmware. It costs £9.95. A full manual for DR Logo is also under way; as only one chapter is devoted to Logo this will be sorely needed.

The program itself is a stripped-down version of Digital Research's full implementation. While rightly described in the manual as a thoughtful version of the language, it is not going to convince anyone that Logo is as powerful as Basic.

CP/M availability

Some reviewers have suggested that it is unlikely that software distributors will make CP/M programs available for the Amstrad. In fact, transferring programs to the Amstrad is a fairly simple business. It breaks down into two stages: writing programs to 3in. discs in the correct format, and customising them for the Amstrad.

The first task is made easy by the fact that BIOS on the DDI-1 system can read discs in IBM PC format. Programs can be ported across from 5.25in. to 3in. discs by adding a 5.25in. drive as a second disc drive.

Customising software for the Amstrad is equally uncomplicated. Most CP/M packages come with an installation program for adapting it to a particular computer — largely a matter of giving details of screen parameters and cursor codes. On top of this the Setup program on the CP/M system disc allows the user to define new keyboard codes, which it then records in the disc's configuration sector.

Provided there is sufficient demand, there is no reason why existing CP/M suppliers should not also cater for the Amstrad. One company, Timatic Systems, is already supplying programs. It takes orders from an extensive CP/M catalogue and in most cases customises programs as well. For £169 the company also sells a single-sided 5.25in. disc drive as a second Amstrad drive.

The main restriction on running programs under Amstrad CP/M is its memory capacity. Though 44.75K of RAM is available, 5K of it is occupied by

Amsoft's CP/M products

Amsoft's first batch of programs running under CP/M are Microscript, Micropen and a scaled-down version of Microcalc, called Mirospread. Each package costs £49, a price which reflects the fact that they are versions of a suite of office software available on many larger systems, and are intended for serious applications.

But at this first taste of the world of serious applications, the home-computer owner may well be somewhat disappointed. The three programs are not markedly superior to their home-computer equivalents such as Psion's Vu-Calc or Amsoft's Amsword.

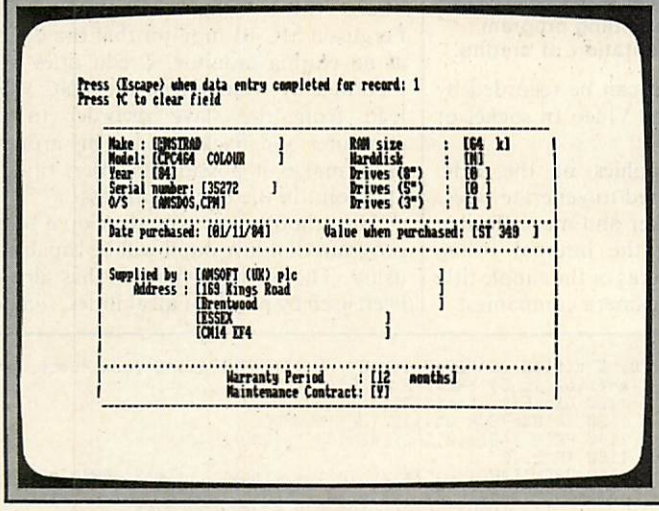
Microscript is a word processor which offers 60 different functions and is certainly more powerful than Amsword. It includes a 16-digit calculator enabling you to total columns of figures vertically and horizontally. It also has a limited programming facility whereby a sequence of instructions can be embedded in the text. Another of the program's advantages is that it can swap files with the database, Micropen.

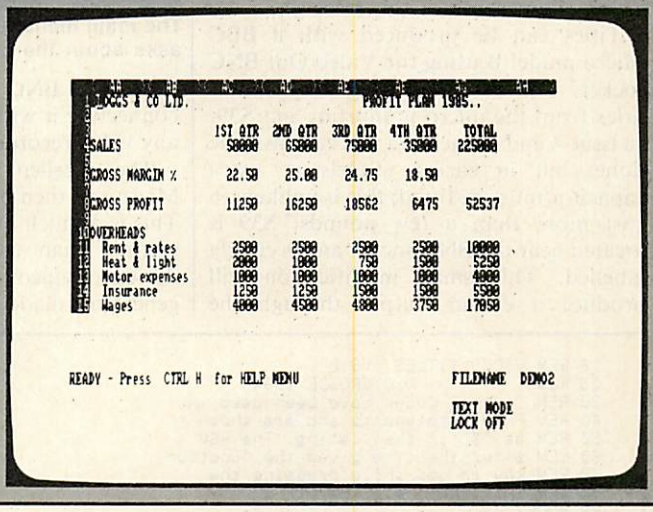
But Microscript has several irritating omissions. Since more time is spent inserting and deleting text than on any other function, every word processor should have Insert and Delete modes. Microscript does have an Insert mode which shoves text along when you enter new words, but deleting requires two steps. First you delete a word, and then you need to pull text leftwards. In this respect Amsword is equally culpable, as it has no Insert mode.

Microspread, the spreadsheet program, is similarly flawed. Its main drawback is that it does not allow you to enter complex formulae. The range of possible operators is limited, while only two cells can be given as parameters.

These judgements may be a trifle unfair, as both programs are badly let down by their documentation. For example, when you enter a formula in Microspread you are presented with a menu of available functions. One of them, Analyse, receives no mention in the manual, while the others are only explained briefly. Even worse, Microscript's manual fails to give an index of the keystrokes needed to access each function.

A further problem with these programs, and indeed with most CP/M software, is that they cannot be configured to work in 40-column mode. Though 80 columns show up well enough on the monochrome monitor it becomes wearing with a colour monitor. It may be possible to solve the problem simply by extending the RGB and power leads.


Press (Escape) when data entry completed for record: 1
Press ^C to clear field
Make : [AMSTRAD]
Model: [CPC464 COLOUR]
Year : [84]
Serial number: [35272]
O/S : [AMSDOS,CP/M]
RAM size : [64 k]
Harddisk : [N]
Drives (8") : [0]
Drives (5") : [0]
Drives (3") : [1]
Date purchased: [01/11/84]
Value when purchased: [ST 349]
Supplied by : [AMSOFT (UK) plc]
Address : [169 Kings Road]
[Brentwood]
[ESSEX]
[CM14 XF4]
Warranty Period : [12 months]
Maintenance Contract: [Y]


BOGGS & CO LTD.
PROFIT PLAN 1985..
1ST QTR 2ND QTR 3RD QTR 4TH QTR TOTAL
SALES 58000 65000 75000 35000 225000
GROSS MARGIN % 22.50 25.00 24.75 18.50
GROSS PROFIT 11250 16250 18562 6475 52537
OVERHEADS
Rent & rates 2500 2500 2500 2500 10000
Heat & light 2000 1000 750 1500 5250
Motor expenses 1000 1000 1000 1000 4000
Insurance 1250 1250 1500 1500 5500
Wages 4000 4500 4800 3750 17050
READY - Press CTRL H for HELP MENU
FILENAME DEMO2
TEXT MODE
LOCK OFF

Above: Amsoft's Micropen database (left) and Microspread Calc program (right). A word processor is also available.

Below: CP/M 2.2 and a cut-down version of DR Logo are included in the price of the DDI-1.

the CCP and BDOS modules. Many of the CP/M classics, such as Supercalc and dBase II, require 48K. An off-the-shelf version of WordStar, for example, will not run on the Amstrad without some modificaton.

Nonetheless the number of CP/M programs in existence — generally reckoned to be well over 3,000 — is large enough to include a great deal of software that will fit into less than 48K. In addition, there is a vast library of free software provided by bodies such as the CP/M Users Group.

Whether the Amstrad user will want to dip into this stockpile is another matter. The price of standardisation is that CP/M progams do not exploit a particular micro's facilities — such as graphics — to the full. And because they have to work through the system's BIOS they are noticeably slower at tasks like scrolling than programs which handle the screen memory directly.

Being able to access CP/M is certainly an advantage for those who want to run specialised applications, utilities or other languages. The Padmede accounting package, for example, is available from Amsoft at a substantially lower price than on larger systems. But it seems unlikely that such goodies will appeal to the average user.

Conclusions

- **As a disc system which costs £199 and comes complete with a disc drive, an interface, CP/M and Logo, the DDI-1 must be considered good value.**
- **Adding CP/M is unlikely to lift the Amstrad out of the home-computer category. The company might have done better to have made its own operating system, Amsdos, more comprehensive and left CP/M as a subsidiary option.**
- **Although Amsdos is comparatively limited, most owners will be content to use it in the way it is intended — as a fast cassette system.** PC

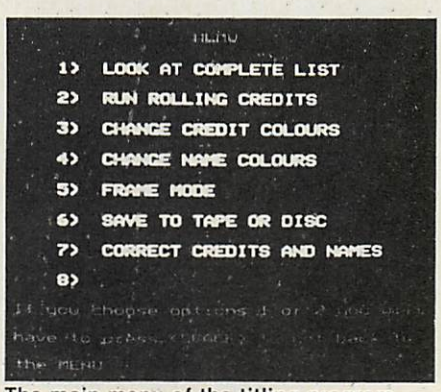
Making movies

Paul Kelley describes how the Television Literacy Project is coming up with cheap and flexible ways of using computers to generate video images, and presents a program for the BBC Micro which schoolchildren have been using to make the title sequences for their own films.

COMPUTERS IN SCHOOLS have become a commonplace. Almost every middle school possesses at least one micro. Even children in primary schools are fast becoming familiar with computers as an everyday piece of classroom equipment.

The newest of the new technology in schools is video, and many are now getting access to colour video cameras. The Television Literacy Project has been looking into ways of combining the two technologies for use by the children themselves. The video titling program in this article is one result of this research.

Titles can be produced with a BBC Micro model B using the Video Out BNC socket. The best way of getting colour titles from the micro is shorting out S39. In issue 4 and 7 machines this can easily be done, but in earlier models an extra capacitor must be fitted; this is unlikely to cost more than a few pounds. S39 is located near the BNC socket and is clearly labelled. This small modification will produce a colour output through the Video Out BNC that can be recorded by connecting it with the Video In socket of any video recorder.


1> LOOK AT COMPLETE LIST
2> RUN ROLLING CREDITS
3> CHANGE CREDIT COLOURS
4> CHANGE NAME COLOURS
5> FRAME MODE
6> SAVE TO TAPE OR DISC
7> CORRECT CREDITS AND NAMES
8>

The main menu of the titling program asks about the presentation of credits.

The excellent graphics of the BBC Micro can then be used to generate titles. This is a much quicker and more flexible method than using the internal titling devices of video cameras or the simple title generators made by camera companies.

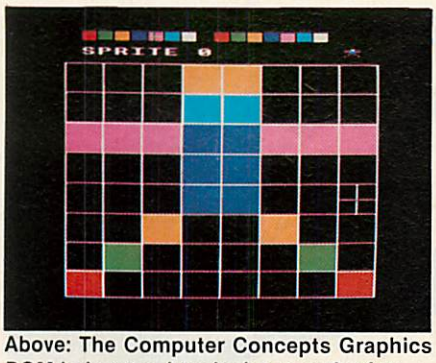
As part of an experiment in teaching television techniques, pupils at Hereford School in Grimsby have been producing their own video films, using BBC Micros to generate titles. It is now easy to get high-quality results using simple home-video equipment, which pupils are perfectly capable of operating. The pupils at Hereford School have been writing and acting in their own videos, and have also videoed school events, sports activities and career work.

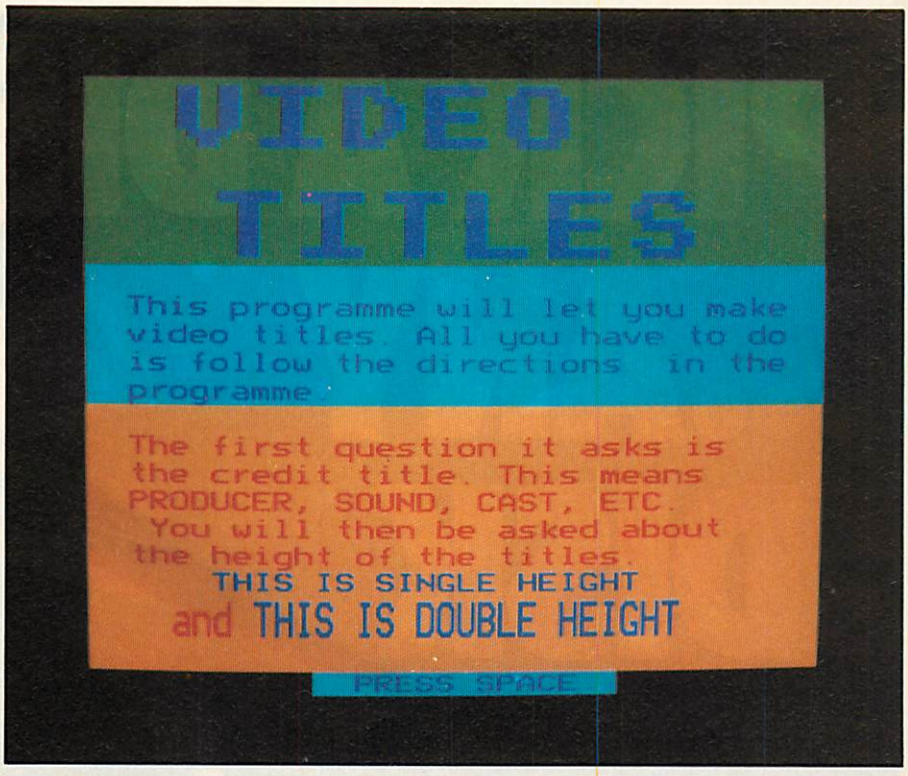
To produce titling, they used a BBC Micro with a Cumana disc drive, and a Ferguson MC-01 monitor that can double as an editing monitor. Credit titles were recorded by transferring the BNC video lead from the slave recorder to the computer and back again. This arrangement makes it possible to insert titles at any point in the editing process.

The school's aim is to develop a titling program that any pupil will be capable of using. The listing given here has already been used by pupils of all abilities, some of

```
   10 REM VIDEO TITLES  V3.0
   20 REM             P.D GROSSE 1984
   30 REM Control Codes have been used in
   40 REM PRINT statements and are shown
   50 REM as "£" in the listing. The REM
   60 REM after the line gives the function
   70 REM key to use while pressing the
   80 REM SHIFT key. e.g REM F1/F2
   90 MODE7
  100 ON ERROR GOTO290
  110 REM <ESCAPE> IS CTRL @
  120 *FX220,0
  130 VDU23;8202;0;0;0;
  140 flag%=0:flag1%=0:FLAG=0:FLAG2%=0:FLAG3%=0:FLAG4%=1
  150 DIM C$(4),N$(40),D$(4),E$(40)
  160 *FX11,0
  170 PRINTTAB(2,2)"£Do you want to load an old list?":A$=GE
T$:REM F2
  180 IF A$="Y" OR A$="y" THEN PROCload:CLS:GOTO230
  190 CLS
  200 PROCinputcredits
  210 PROCaddcredits
  220 :CLS:PROCinputname
  230 PROCcolourchoice("£CREDITS£"):REM F2/F7
  240 IF flag%=0 THEN PROCsingleC ELSE PROCdoubleC
  250 CLS
  260 PROCcolourchoice("£NAMES£"):REM F2/F7
  270 CLS:IF flag1%=0 THEN PROCsingleN ELSE PROCdoubleN
  280 CLS:PROCmenu
  290 REM RESET
  300 *FX12,0
  310 *FX220,27
  320 END
 1000 DEFPROCinputcredits
 1010 PRINTTAB(5,1)"£CREDITS":REM F2
 1020 FORN%=0TO4:PRINTTAB(5,2+N%)C$(N%):NEXT
 1030 ENDPROC
 1040 DEFPROCaddcredits
 1050 X%=0
 1060 REPEAT
 1070 REPEAT
 1080 IF C$(X%)<>"" THENX%=X%+1
 1090 UNTIL C$(X%)=""
 1100 *FX21,0
 1110 PRINTTAB(2,8)"£Do you want to type in a credit"TAB(1,1
0)"£ title£ (CAMERAS,etc)£ Y/N ?£"TAB(1,12)"£ (max number of
 entries is 5)":REM F3/F3/F6/F3/F7/F1
 1120 G$=GET$:G%=ASC(G$)
 1130 IF G%=78OR G%=110 THEN ENDPROC
 1140 PRINTTAB(1,8)SPC(140)TAB(1,12)SPC(40)
 1150 *FX21,0
 1160 PRINTTAB(1,8)"£What is the credit title?£":PRINT:PRINT
" £maximum length 20 letters£":PRINT:PRINT"£     .....
.......!";:INPUTTAB(5,12)B$:REM F3/F7/F2/F7/F5
 1170  IF LEN(B$)>20 THEN CLS:GOTO1160
 1180 PRINTTAB(1,15)"£Is this correct?":REM F5
 1190 *FX21,0
 1200 G$=GET$:G%=ASC(G$)
 1210 IF G%=78 OR G%=110 THEN PRINTTAB(1,8)SPC(160)TAB(1,12)
SPC200:GOTO1100
 1220 C$(X%)=B$
 1230 CLS:PROCinputcredits
 1240 X%=X%+1
 1250 UNTIL X%=5 OR B$=""
 1260 ENDPROC
 1270 DEFPROCinputname
 1280 LOCAL X%,Y%,M%
 1290 FOR F%=0TO4
 1300 Y%=0:M%=0
 1310 REPEAT
 1320 IF N$(X%)<>"" THENX%=X%+1:FLAG4%=1
 1330 UNTIL N$(X%)=""
 1340  PRINTTAB(15,2)"£What are their names?":PRINTTAB(15,4)
"£Type in one name at a"TAB(15,6)"£time and press RETURN£"TA
B(15,8)"£No more than 20 letters£":PRINTTAB(15,10)"£.....
.....!":REMF5/F5/F5/F7/F2/F7/F6
 1350 PRINTTAB(2,5)"£CREDIT£"TAB(2,8)C$(F%)
 1360 IF C$(F%)=""THEN 1520
 1370 INPUTTAB(16,10)n$
 1380  IF LEN(n$)>20 THENPRINTTAB(15,2)SPC(22)TAB(15,4)SPC(2
2)TAB(15,6)SPC(22)TAB(15,8)SPC(22)TAB(15,10)SPC(26)TAB(15,12
)SPC(22):GOTO1340
 1390 PRINTTAB(8,23)"£Is this correct(Y/N)£";:REM F3/F7
 1400 *FX21,0
 1410 G$=GET$:G%=ASC(G$)
 1420 IF G%=78OR G%=110 THENPRINTTAB(8,23)SPC(23)TAB(15,10)S
PC(22)TAB(15,10)"£.....!";:GOTO1370:REM F6
 1430 N$(X%)=n$
 1440 VDU28,5,20,25,12:PRINTTAB(0,M%)N$(X%):M%=M%+1:IF M%>8
```

(listing continued on page 90)




VIDEO
TITLES
This programme will let you make video titles. All you have to do is follow the directions in the programme.
The first question it asks is the credit title. This means PRODUCER, SOUND, CAST, ETC.
You will then be asked about the height of the titles.
THIS IS SINGLE HEIGHT
and THIS IS DOUBLE HEIGHT
PRESS SPACE

Above: The Computer Concepts Graphics ROM being used to design a sprite for animated displays. Computer-generated cartoon films may be possible eventually. Above right: Opening display. Below right: Some of the large lettering generated by the program.

whom have had no previous computer experience at all. Using computers in this way not only improves the quality of video work, it also offers an introduction to computers.

The program as it now stands will generate credits. It starts by asking if a credit title is needed for cameras, cast and so on, and users are asked after each entry if it is correct. They are then asked to give the names of the people involved, which are stored.

The user is asked about the presentation of the credits: whether they should be in single or double height; colours for credit title and credit names, which may be different; and what speed the credits run and what speed the characters appear. The menu also has room for other developments, such as the ability to have the titles saved on tape or disc. The program can also be used to create opening titles, or titles for any point in a video.

Further developments include the use of the Computer Concepts Graphics ROM to perform some of the graphics-generating functions. The Computer Concepts ROM help users to perform four major tasks; sprite graphics, turtle graphics, scaling, and simplifying some graphics capabilities.

In one version of the final program pupils are to have the facility of creating their own sprites and making their own sprite films. This will bring the possibility of animated illustrations, and perhaps even videos that are entirely done by computer. The final program for titles and animation will be published by the Microelectronics in Education Programme.

Further into the future lies interactive video for schools. Ravi Singh of the National Computing Centre has developed a new interface that links a BBC Micro with a video recorder. Using a monitor like the MC-01, true interactive video is possible: the computer controls the video recorder, showing the pupil video material, and then allows the pupil to answer questions, review material, and so on.

The NCC interface links equipment schools already have, and allows them to use video material — either made in school or bought from a commercial supplier — in a way which at present is only possible with expensive dedicated video-disc players.

The Television Literacy Project

The TVLP aims to help the introduction and study of television and video in schools, especially computer graphics and computer-video links. The Project is sponsored by the Independent Broadcasting Authority, Radio Rentals Contracts and the Humberside Education authority. TVLP would be interested to hear from companies and teachers with similar interests. All teaching material from the Project will be available at cost price; all programs and findings are freely available to teachers and may be used in schools without payment. For further information contact TVLP, 75 Mill Road, Cleethorpes, South Humberside DN35 8JB.

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The M-F-B, made available at prices that 'drives' the opposition away, comes supplied with a six-month free format update service.

So, if you are the head of a Data Processing department seeking a solution to ever increasing incompatibility amongst departmental computers, or the M.D. of a software house looking for a way to prevent further loss of sales due to the fact that you cannot supply software on the required disk format, then look no further... The next microcomputer purchase that your company will make is that of a Gemini Multi-Format-BIOS system.

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(continued from page 88)

```
THEN M%=8
 1450 VDU26
 1460 X%=X%+1:Y%=Y%+1:PRINTTAB(16,10)SPC(23)TAB(15,10)"Σ....
.................:":REM F6
 1470 PRINTTAB(8,23)"ΣAnymore names (Y/N) ?Σ";:REM F3/F7
 1480 G$=GET$:G%=ASC(G$)
 1490 IFG%=89OR G%=121 THENPRINTTAB(8,23)SPC(23):GOTO1370
 1500 IF G%<>89 OR G%<>121 THEN N$(X%)="XXX":X%=X%+1
 1510 CLS
 1520 NEXT
 1530 CLS
 1540 ENDPROC
 1550 DEFPROCprint(X%,Y%,Z%,W%,T%)
 1560 LOCAL S%,F%
 1570 S%=0
 1580 FOR F%=0TO4
 1590 PRINT:PRINT
 1600 IF flag%=0 THENPRINTTAB(X%,Y%)D$(F%) ELSE PRINTTAB(X%,
Y%)D$(F%):PRINTTAB(X%,Y%+1)D$(F%)
 1610 IF N$(S%)="XXX"THEN 1660
 1620 PRINT
 1630 IF flag1%=0 THENPRINTTAB(Z%,W%)E$(S%) ELSEPRINTTAB(Z%,
W%)E$(S%):PRINTTAB(Z%,W%+1)E$(S%)
 1640 PROCdelay(T%):PRINTTAB(Z%,W%)SPC(23):PRINTTAB(Z%,W%+1)
SPC(23)
 1650 S%=S%+1
 1660 IF C$(F%)="" THEN F%=4:GOTO1700
 1670 GOTO1610
 1680 S%=S%+1:PRINTTAB(X%,Y%)SPC23TAB(X%,Y%+1)SPC23
 1690 NEXT
 1700 IF FLAG=1 THEN FLAG=0:ENDPROC
 1710 FORK%=1 TO24:VDU10,10,10
 1720 IF INKEY(-99)  THEN K%=25:ENDPROC
 1730 PROCdelay(T%):NEXT
 1740 ENDPROC
 1750 DEFPROCcolourchoice(A$)
 1760 *FX21,0
 1770 PRINTTAB(2,2)"Do you want single or double height"TAB(
2,4)"print for the";A$;"?"TAB(2,6)"(PressΣCΣfor SingleΣDΣfor
 Double)":REM F3/F7/F3/F7
 1780 G$=GET$:G%=ASC(G$)
 1790 IFMID$(A$,2,1)="C" AND G%=68 OR G%=100 THEN flag%=1
 1800 IFMID$(A$,2,1)="N" AND G%=68 OR G%=100 THEN flag1%=1
 1810 CLS
 1820 ENDPROC
 1830 DEFPROCsingleC
 1840 *FX21,0
 1850 VDU31,9,2,129,255,32,130,255,32,131,255,32,132,255,32,
133,255,32,134,255,32,135,255,32
 1860 PRINTTAB(10,4)"1  2  3  4  5  6  7"
 1870 PRINTTAB(2,8)"Choose the number of the colour you"TAB(
2,9)"require (then pressΣΣRETURNΣ) ";:INPUTTAB(32,9)N%:REM F
1/F7
 1880 IF N%<1 OR N%>7 THEN 1870
 1890 FOR B%=0TO4
 1900 D$(B%)=CHR$(128+N%)+C$(B%)+CHR$135
 1910 NEXT
 1920 ENDPROC
 1930 DEFPROCdoubleC
 1940 *FX21,0
 1950 VDU31,9,2,129,255,32,130,255,32,131,255,32,132,255,32,
133,255,32,134,255,32,135,255,32
 1960 PRINTTAB(10,4)"1  2  3  4  5  6  7"
 1970  PRINTTAB(2,8)"ChooseΣthe number of the colour you"TAB
(2,9)"require (then pressΣΣRETURNΣ) ";:INPUTTAB(32,9)N%:REM
F1/F7
 1980 IF N%<1 OR N%>7 THEN 1870
 1990 FOR B%=0TO4
 2000 D$(B%)=CHR$141+CHR$(128+N%)+C$(B%)+CHR$135+CHR$140
 2010 NEXT
 2020 ENDPROC
 2030 DEFPROCsingleN
 2040 *FX21,0
 2050 VDU31,9,2,129,255,32,130,255,32,131,255,32,132,255,32,
133,255,32,134,255,32,135,255,32
 2060 PRINTTAB(10,4)"1  2  3  4  5  6  7"
 2070 PRINTTAB(2,8)"Choose the number of the colour you"TAB(
2,9)"require (then pressΣΣRETURNΣ) ";:INPUTTAB(32,9)N%:REM F
1/F7
 2080 IF N%<1 OR N%>7 THEN 2070
 2090 FOR B%=0TO40
 2100 E$(B%)=CHR$(128+N%)+N$(B%)+CHR$135
 2110 NEXT
 2120 ENDPROC
 2130 DEFPROCdoubleN
 2140 *FX21,0
 2150 VDU31,9,2,129,255,32,130,255,32,131,255,32,132,255,32,
133,255,32,134,255,32,135,255,32
 2160 PRINTTAB(10,4)"1  2  3  4  5  6  7"     -
 2170 PRINTTAB(2,8)"ChooseΣthe number of the colour you"TAB(
2,9)"require (then pressΣΣRETURNΣ) ";.INPUTTAB(32,9)N%:REM F
1/F7
 2180 IF N%<1 OR N%>7 THEN 2070
 2190 FOR B%=0TO40
 2200 E$(B%)=CHR$141+CHR$(128+N%)+N$(B%)+CHR$135+CHR$140
 2210 NEXT
 2220 ENDPROC
 2230 DEFPROCmenu
 2240 *FX21,0
 2250 PRINTTAB(10,1)CHR$141;CHR$129"MENU";TAB(10,2)CHR$141;C
HR$130"MENU"
 2260 PRINTTAB(5,4)"Σ1) ΣLOOK AT COMPLETE LISTΣ":REM F6/F5/F
7
 2270 PRINTTAB(5,6)"Σ2) ΣRUN ROLLING CREDITSΣ":REM F6/F5/F7
 2280 PRINTTAB(5,8)"Σ3)Σ CHANGE CREDIT COLOURSΣ":REM F6/F5/F
7
 2290 PRINTTAB(5,10)"Σ4)Σ CHANGE NAME COLOURSΣ":REM F6/F5/F7
 2300 PRINTTAB(5,12)"Σ5)Σ FRAME MODEΣ":REM F6/F5/F7
 2310 PRINTTAB(5,14)"Σ6)Σ SAVE TO TAPE OR DISCΣ":REM F6/F5/F
7
 2320 PRINTTAB(5,16)"Σ7)Σ CORRECT CREDITS AND NAMESΣ":REM F6
/F5/F7
 2330 PRINTTAB(5,18)"Σ8)Σ END THE PROGRAMΣ":REM F6/F1/F7
 2340 PRINTTAB(1,20)"ΣIf you choose options 1 or 2 you will"
TAB(1,22)"Σhave to press <SPACE> to get back to"TAB(1,24)"Σt
he MENUΣ";:REM F2/F2/F2/F7
 2350 A%=VAL(GET$)
 2360 IF A%<1OR A%>8 THEN 2350
 2370 CLS
 2380  ON A% GOTO 2390,2400,2410,2420,2450,2460,2470,2490
 2390 PROCspeed:CLS:FLAG=1:PROCprint(15,10,15,14,T%):GOTO240
0
 2400 PROCspeed:CLS:PROCprint(2,22,2,20,T%):GOTO2480
 2410 flag%=0:PROCcolourchoice("ΣCREDITSΣ"):IF flag%=0 PROCs
ingleC ELSE PROCdoubleC:REM F2/F7
 2420 CLS:GOTO2240
 2430 flag1%=0:PROCcolourchoice("ΣNAMESΣ"):IFflag1%=0THEN PR
OCsingleN ELSE PROCdoubleN:REM F2/F7
 2440 CLS:GOTO2240
 2450 CLS:PROCframe:CLS:GOTO2240
 2460 CLS:PROCsave:CLS:GOTO2240
 2470 PROCEDIT:CLS:GOTO2250
 2480 REPEAT UNTIL GET=32:CLS:GOTO2240
 2490 ENDPROC
 2500 DEFPROCspeed
 2510 CLS
 2520 PRINTTAB(2,2)"ΣChoose one of the following speeds":REM
F3
 2530 PRINTTAB(2,4)"Σfor the scrolling":REM F3
 2540 PRINTTAB(2,10)"Σ1     2     3     4     5     6":REM F
5
 2550 PRINTTAB(2,12)"ΣFAST                              SLOW":RE
M F2
 2560 U%=VAL(GET$)
 2570 T%=U%
 2580 ENDPROC
 2590 DEFPROCwait
 2600 PRINTTAB(8,24)"ΣPressΣSPACEΣto continue";:REM F5/F7/F5
 2610 REPEAT UNTIL GET=32
 2620 ENDPROC
 2630 DEFPROCdelay(T%)
 2640 TIME=0
 2650 REPEAT UNTIL TIME=T%+50
 2660 ENDPROC
 2670 DEFPROCframe
 2680 LOCALK%,T%:K%=0
 2690 CLS
 2700 IF flag%=1 OR flag1%=1 THEN PRINT"ΣYou must use single
 height for the"'"Σframe mode. PressΣspaceΣto return toΣ"''
"Σthe menu so that you can changeΣ":REM F6/F6/F3/F6/F7/F6/F7
 2710  IF flag%=1 PRINT''"ΣtheΣ CREDITΣ titles.":REM F6/F2/F
6
 2720 IF flag1%=1 PRINT''"ΣtheΣ NAMES.Σ":REM F6/F2/F6
 2730 REPEAT UNTIL GET=32
 2740 IF flag%=1 OR flag1%=1 THEN ENDPROC
 2750 FOR H%=0TO4
 2760 PRINTTAB(2,6)D$(H%).PRINT
 2770 T%=0
 2780 PRINTTAB(2,T%+8)E$(K%):K%=K%+1:T%=T%+1
 2790 IF K%=41THEN GOTO2800
 2800 IF T%>15 THEN REPEAT UNTIL GET=32:CLS:GOTO2760
 2810 IF MID$(E$(K%-1),2,1)="X" THEN PRINTTAB(2,T%+8-1)"
":GOTO2840
 2820 GOTO2780
 2830 PRINT
 2840 REPEAT UNTIL GET=32:CLS
 2850 NEXT
 2860 REPEAT UNTIL GET =32
 2870 ENDPROC
 2880 DEFPROCsave
 2890 IF FNtape_disc=4 THEN PROCwarn ELSE PROCmessage
 2900 IF F=0 THEN ENDPROC
 2910  IF F=1 THEN PRINTTAB(15,16)"ΣΣSAVINGΣΣ":REM F3/F8/F7/
F9
 2920 n%=OPENOUT"Credits"
 2930 FOR N%=0TO4
 2940 PRINT#n%,C$(N%):NEXT
 2950 CLOSE#n%
 2960 n1%=OPENOUT"Names"
 2970 FOR N%=0TO40
 2980 PRINT#n1%,N$(N%):NEXT
 2990 CLOSE#n1%
 3000 ENDPROC
 3010 DEFPROCload
 3020 IF FNtape_disc=4 THEN 3040
 3030 IF FNtape_disc=1 THEN PRINTTAB(2,4)"ΣPress ΣPLAY Σon t
he tape recorderΣ":PROCdelay(8):PRINT:PRINT:PRINT"ΣAre you r
eady? Press YΣ":A$=GET$:IF A$="Y" OR A$="y" THEN PRINTTAB(15
,18)"ΣΣLOADINGΣΣ" ELSE CLS: GOTO3030
 3031 REM F3/F5/F3/F7/F3/F7/F2/F8/F7/F9
 3040 n%=OPENUP"Credits"
```

(continued on next page)

(continued from previous page)

```
3050 FOR N%=0TO4
3060 INPUT#n%,C$(N%)
3070 NEXT
3080 CLOSE#n%
3090 n1%=OPENUP"Names"
3100 FOR N%=0TO40
3110 INPUT#n1%,N$(N%):NEXT:CLOSE#n1%
3120 ENDPROC
3130 DEFPROCEDIT
3140 CLS
3150 PROCeditC
3160 CLS:PROCeditN
3170 CLS:flag%=0:PROCcolourchoice("£CREDITS£"):IF flag%=0 P
ROCsingleC ELSE PROCdoubleC:REM F2/F7
3180 CLS:flag1%=0:PROCcolourchoice("£NAMES£"):IFflag1%=0THE
N PROCsingleN ELSE PROCdoubleN:REM F2/F7
3190 ENDPROC
3200 DEFPROCeditC
3210 LOCALs%
3220 FOR s%=0 TO4
3230 PRINTTAB(1,1+s%)s%+1," ",C$(s%)
3240 NEXT
3250 INPUTTAB(2,8)"£Choose the number of the CREDIT"''"£ yo
u wish to change (Press£'0'£for£"''" £no change£" j%:REM F3
/F3/F1/F3/F7/F3/F7
3260 IF j%=0 THEN ENDPROC
3270 IF j%<1 OR j%>5 THENPRINTTAB(13,12)"    ":GOTO3250
3280 PRINTTAB(4,12)C$(j%-1)
3290 INPUT TAB(2,14)"£Type in the correct£CREDIT£"TAB(8,16)
"£.....:"TAB(9,16) F$:REM F3/F2/F7/F6
3300 IF LEN(F$)>20 THEN CLS:GOTO3220
3310 C$(j%-1)=F$
3320 PRINTTAB(2,23)"£Do you want to change any more Y/N ?£"
;:G$=GET$:G%=ASC(G$):IF G%=78 OR G%=110 THEN ENDPROC:REM F5/
F7
3330 CLS:GOTO3220
3340 STOP
3350 ENDPROC
3360 DEFPROCeditN
3370 LOCALK%,T%:K%=0
3380 FOR H%=0TO4
3390 IF C$(H%)="" THEN H%=4:K%=41:ENDPROC
3400 PRINTTAB(2,1)C$(H%):PRINT
3410 T%=0
3420 PRINTTAB(10,T%+3);K%+1;"  ";N$(K%):K%=K%+1:T%=T%+1
3430 IF K%=41THEN GOTO 3500
3440 IF T%>15 THEN REPEAT UNTIL GET=32:CLS:GOTO3400
3450 IF MID$(N$(K%-1),2,1)="X" THEN PRINTTAB(10,T%+2)"
  ":GOTO3460
3460 GOTO3420
3470 PRINT
3480 PROCchange
3490 NEXT
3500 REPEAT UNTIL GET=32
3510 ENDPROC
3520 DEFPROCchange
3530 PRINTTAB(2,23)"£Do you want to change£NAMES£Y/N£?£";:G
$=GET$:G%=ASC(G$):IF G%=78 OR G%=110 THEN CLS:ENDPROC:REM F5
/F2/F5/F7
3540 PRINTTAB(2,23)SPC(37);:GOTO3550
3550 INPUTTAB(2,21)"£Choose the number of the£NAME£"TAB(2,2
3)"£you want to change£" c%:REM F5/F2/F7/F5/F7
3560 IF c%<0 OR c%>K% THEN PRINTTAB(23,23)"    ";:GOTO3550
3570 PRINTTAB(2,21)SPC(90);
3580 INPUT TAB(2,21)"£Type in the correct£NAME£"TAB(8,23)"£
.....:";TAB(9,23) H$:REM F3/F2/F7/F6
3590 N$(c%-1)=H$
3600 PRINTTAB(2,23)"£Do you want to change any more Y/N ?£"
;:G$=GET$:G%=ASC(G$):IF G%=78 OR G%=110 THEN CLS:ENDPROC:REM
F5/F7
3610 PRINTTAB(2,23)SPC(37);:GOTO3550
3620 ENDPROC
3630 DEFPROCwarn
3640 PRINTTAB(14,2)CHR$141;CHR$130;CHR$129;"WARNING";TAB(14
,3)CHR$141;CHR$130;CHR$129;"WARNING"
3650 PRINTTAB(1,6)"£SAVING TO DISC WILL OVERWRITE ANY","£EX
ISTING FILE£"
3660 PRINTTAB(1,9)"£IF YOU DONOT WISH TO OVERWRITE AN","£EX
ISTING FILE THEN SAVE THIS LIST","£ONTO ANOTHER DISC£"
3670 PRINTTAB(1,14)"£DO YOU WISH TO SAVE THIS LIST"'" £PRES
S£Y£(yes) OR£N£(no)£":A$=GET$
3680 IF A$="Y" OR A$="y" THEN F=TRUE ELSE F=FALSE
3690 ENDPROC
3700 DEFPROCmessage
3710 *OPT1,0
3720 PRINTTAB(2,4)"£Make sure the tape is wound to","£the c
orrect place"''"£Press£RECORD£and£PLAY£on the tape","£record
er"''"£Are you ready to start to save the","£list? Y(es) OR
 N(o)£":A$=GET$
3721 REM F2/F2/F3/F1/F3/F1/F3/F3/F2/F2/F7
3730 IF A$="Y" OR A$="y" THEN F=1:ENDPROC
3740 PRINTTAB(2,11)SPC(200):GOTO3720
3750 ENDPROC
3760 END
3770 DEF FNtape_disc
3780 C%=&70
3790 Y%=0
3800 A%=0
3810 =USR(&FFDA)AND &FF
```

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The missing link

Getting a particular peripheral to work with your micro system remains a major headache. John Lewell describes how the Small Computer Systems Interface could bring such problems to an end.

THE PROBLEM of interfacing a number of peripheral devices to a small computer system is one that is familiar to designers, sellers and users alike. While nearly all systems have some expansion capability, it is impossible to implement without considerable effort being expended on finding precisely the correct way of doing it.

For the user in particular, this is a major vexation. When someone buys a new peripheral they may discover that the computer's operating system needs an additional peripheral driver module. Likewise, the hardware itself may require an extra interface card. In turn, the card may have to be housed in an additional card cage if the system backplane has no extra slots available.

Such practical minutiae are becoming increasingly important. More users are now adding high-performance peripherals such as small Winchester discs to their computer systems. They need the convenience of standardisation without the reduction in performance that all too often comes with it.

Best of both worlds

The Small Computer Systems Interface, SCSI, is an attempt to get the best of both worlds. The aim is to allow users to buy any high-performance peripheral of their choice, plug it straight into their computer, and operate it without further ado.

Briefly, SCSI is a specification for a peripheral bus and command set. It has been conceived as a high-performance peripheral interface that will allow data to be distributed among peripherals independently of the host, thus freeing the host for more user-orientated activities.

The use of a bus as a peripheral interface is a radical departure from conventional practice. The term "interface" normally refers to connections that will support only two devices. Under this terminology, the ubiquitous RS-232 is an interface because it allows only one sender and one receiver.

Most peripheral interfaces are restricted by this definition. The ST-506 specification allows only one disc and one controller on each radial connection. A single controller may support four disc drives, but it uses four separate interfaces to do it.

In sharp contrast, a bus has multiple, independent, interchangeable slots. This concept is crucial to the performance advantages of SCSI. Buses are, of course, already familiar features of computer systems. They carry data, addresses, control signals and power to different components within the computer.

Since the SCSI bus, like the computer bus, is a digital link, it is worthwhile to be comparing it with the more familiar backplane bus, and to note the similarities and differences. The block diagram of a system using SCSI shows a basic architectural similarity between the two concepts — see figure 2. Apart from the obvious discrepancy in scale between the kinds of components that are being linked — printers and discs, as opposed to microprocessors, ROMs and RAMs — important similarities emerge in signal organisation, multiple-master capability and operational phases.

The SCSI signal set looks very much like a backplane bus. The set contains a data bus of eight bits, and various control/status signals. These signals are located on the same pins at all points on the bus, with no daisy-chaining or physical positioning required for any purpose.

Second, as with many of the more sophisticated backplane buses, SCSI has a multi-master capability. In this respect, it is superior to many backplane buses, some of which establish priority by hard-wired techniques such as daisy-chained priority lines, while others use a voting cycle on the bus. Fortunately for user convenience, the SCSI establishes master priority exclusively in the voting or arbitration cycle, with no physical modification required.

Third, like most backplane buses, SCSI defines several operational cycles or bus phases. It has the normal read and write phases that are needed for information transfer; in addition, the specification includes several other phases to accomplish the bus arbitration necessary for multi-master operation.

Figure 1. Bus arbitration.

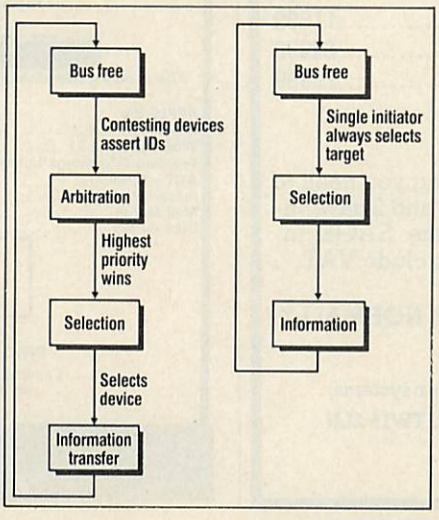

Figure 1 shows how this works. When one device completes its information transfer or becomes blocked it releases the SCSI bus, which then enters the Bus Free phase. Noting that the bus is free, another SCSI device may try to claim it by putting its priority out on the address bus. The highest priority wins, thus concluding the arbitration phase.

If the similaraities between SCSI and backplane buses are striking, the differences can highlight the unique features of SCSI. Although both are computer buses in the broad sense, their goals are different, and examination of this fundamental difference of purpose shows more clearly how SCSI differs from conventional buses.

Few restrictions

Backplane buses are designed for transfers between many types of modules or circuit boards that may have many functions and varying levels of intelligence. A CPU module, for example, may have extremely sophisticated bus command and response capabilities, while the prime function of a memory module is to respond to a given address with a read or write cycle as quickly as possible. In order to accommodate all these functions, the backplane bus must provide as few restrictions as are absolutely necessary.

The SCSI bus, on the other hand, facilitates bulk data transfers among peripheral devices and hosts. In other words, all devices plugged into an SCSI bus have some gross similarities. Consequently, the SCSI specification can assume some level of sophisticated response capability from each device, allowing the definition of an entire command set.

Because of this functional distinction, SCSI departs from conventional bus design in four specific aspects: implementation, command set definition, data-rate restrictions, and message and data transfer sequences.

Backplane buses are typically implemented on a printed-circuit motherboard, housed in a card cage. This approach, which makes the mechanical housing an integral part of the electronic interconnection, is very convenient for the computer cards.

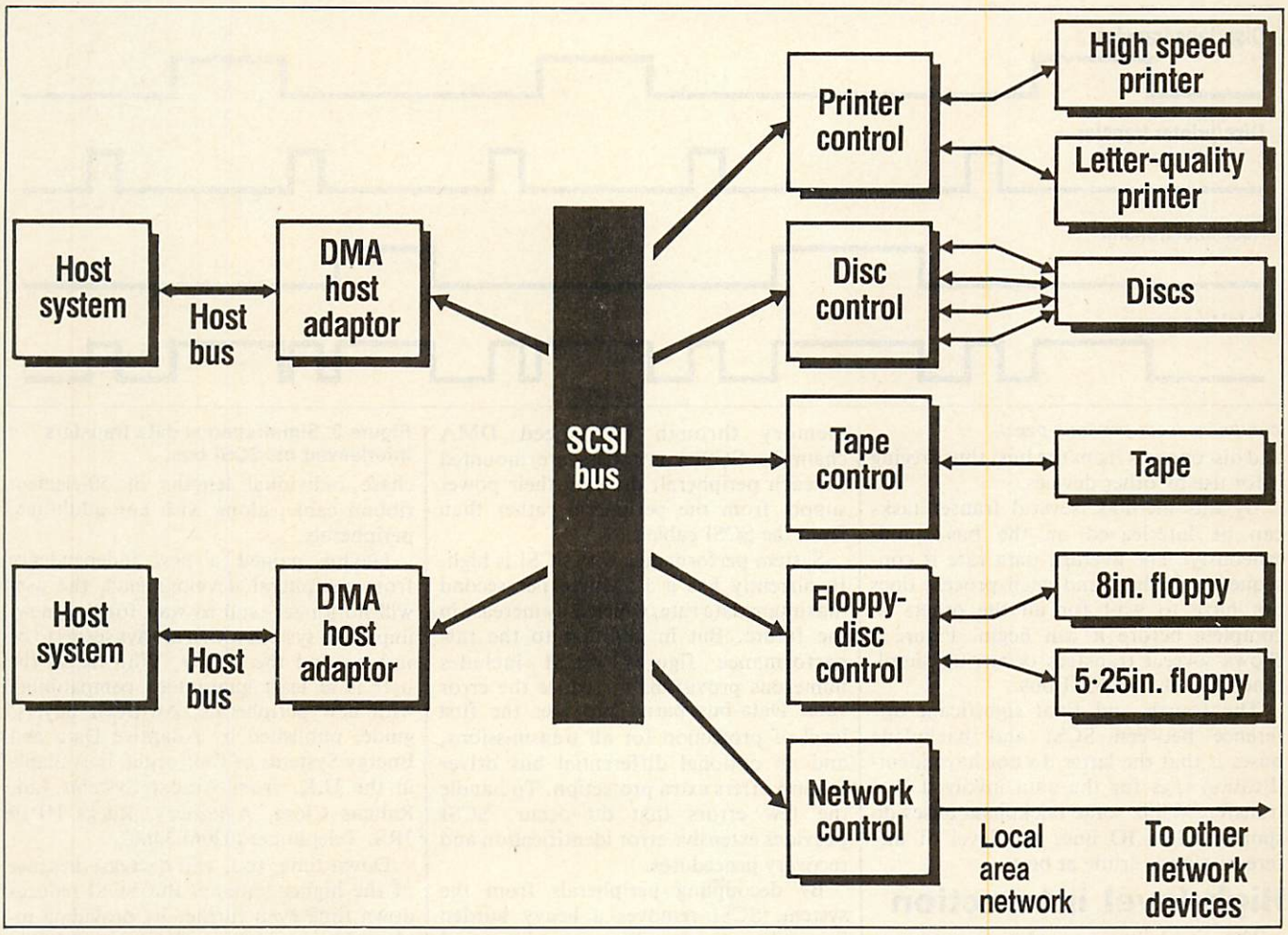

Figure 2. SCSI bus architecture.

Table 1. SCSI connector definition.

Signal	Pin	Signal	Pin
Ground	1	Ground	2
Data bus 0	3	Ground	4
Data bus 1	5	Ground	6
Data bus 2	7	Ground	8
Data bus 3	9	Ground	10
Data bus 4	11	Ground	12
Data bus 5	13	Ground	14
Data bus 6	15	Ground	16
Data bus 7	17	Ground	18
Bus parity	19	Ground	20
Spare	21	Ground	22
Spare	23	Ground	24
Spare	25	Ground	26
Spare	27	Ground	28
Attention	29	Ground	30
Ground	31	Ground	32
Busy	33	Ground	34
Acknowledge	35	Ground	36
Reset	37	Ground	38
Message	39	Ground	40
Select	41	Ground	42
Cmd/Data	43	Ground	44
Request	45	Ground	46
I/O	47	Ground	48
Ground	49	Ground	50

Table 2. SCSI signal definition.

DB0 — data bus bit 0
DB0 — data bus bit 1
DB0 — data bus bit 2
DB0 — data bus bit 3
DB0 — data bus bit 4
DB0 — data bus bit 5
DB0 — data bus bit 6
DB0 — data bus bit 7
ATN — Attention; indicates Initiator has message to send to target
BSY — Busy; bus is busy
ACK — Acknowledge; with REQ, completes asynchronous handshake for data bus transfers
RST — Reset; clears all activity on bus
MSG — Message; indicates bus is in message-transfer phase
SEL — Select; used during device-selection phase
C/D — Command/Data; defines type of information on bus — Command/Status or Data
REQ — Request; with ACK, completes handshake for data bus transfers
I/O — Input/Output; indicates direction of data flow on data bus

Peripheral controllers, in contrast to computer cards, have well-defined mounting locations directly on top of the associated peripherals. In fact, the mounting holes on some peripheral devices are almost as standardised as the electrical interfaces.

Thus the SCSI bus is implemented in a 50-pin ribbon cable. This is the natural interconnection mechanism for peripherals when the controllers are mounted on the peripheral devices themselves. The mounting arrangement is largely determined by the significant power, cooling, and space requirements of peripherals. Table 1 shows the signal locations on the ribbon cable, while table 2 shows the SCSI signal definitions.

In computers, the command set is more properly a function of the CPU than the backplane choice. For example, many microprocessors are available on microcomputer buses such as Multibus, S-100, STD, etc., so the command set has to be independent of the backplane.

But SCSI includes a comprehensive command-set definition. For the SCSI bus, the command set is integral to the entire concept of the I/O bus. Fixing the I/O driver modules in the operating system frees the system designer from the traditional constraints imposed by the suppliers of peripherals and controllers. In addition, the high-level, block-orientated command set of the SCSI forces the host CPU to offload the peripheral housekeeping tasks to the controller.

Most backplane buses place no restrictions on the minimum burst data rate. The timing specifies the maximum data rate, but the ideal time between each data transfer is unlimited. In contrast, a key feature of SCSI is the implicit minimum limitation on the average data rate.

Each controller on the SCSI bus is intelligent enough to know when it must stall a transfer. It must be able to tell when a receiving device is full and when a sending device is empty. At the stall point, the intelligent device breaks the transfer

(continued on next page)

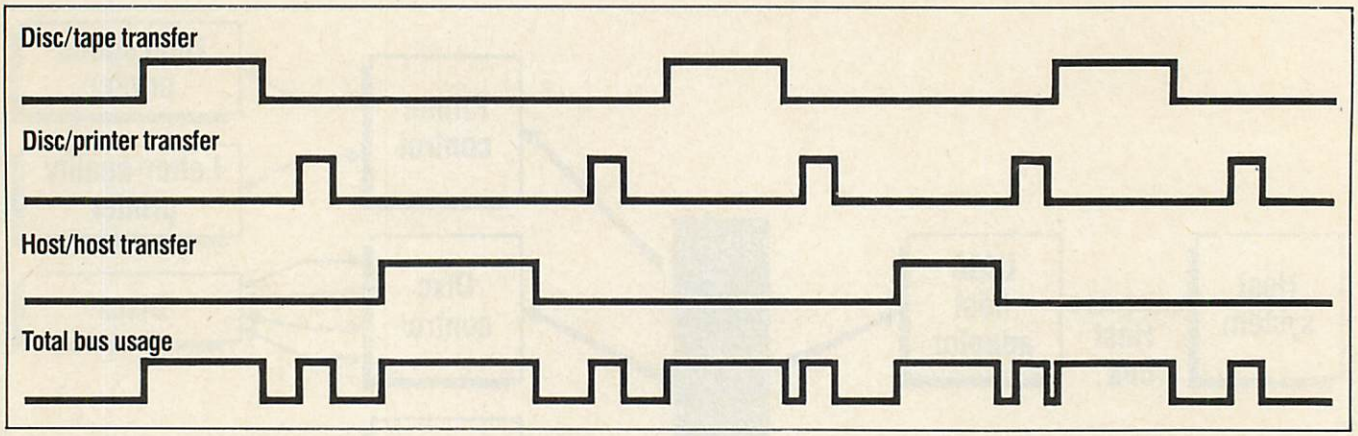

Figure 3. Simultaneous data transfers interleaved on SCSI bus.

(continued from previous page)

and disconnects from the bus, thus freeing it for use by other devices.

By this method, several transer tasks can be interleaved on the bus simultaneously. The average data rate is consequently higher, and each process does not have to wait for all the others to complete before it can begin. Figure 3 shows several transfers occurring simultaneously on the SCSI bus.

The fourth and final significant difference between SCSI and backplane buses is that the latter do not have identification tags for the data involved in a transfer. While some backplane buses do sport a Mem/IO line, this level of differentiation is crude at best.

High-level interaction

The SCSI bus provides a hardware signal for identification of message and data transfers. Controllers communicate with each other via messages, and this allows a very high level of interaction preconditioning for the data transfers.

SCSI offers advantages to three groups of people in the computer world: systems designers, system distributors and retailers, and end-users. For all these people it represents another stage in the evolution of the home computer towards being a system of interchangeable components.

SCSI simplifies almost all phases of system design. It offers major enhancements in the areas of software integration, hardware integration and system performance. In software integration, the SCSI command set allows the operating system to work at a higher level. Instead of computing the desired head, cylinder and sector address location, the OS can simply specify a logical block number, because the SCSI controllers handle all the logical-to-physical mapping.

The SCSI command set can place all the differences between disc families into the controller, so the OS needs only one disc driver, not one for each type of disc.

In hardware integration, the system designer using SCSI need design only one connection to the bus, which will handle all the peripherals for the entire system. The best design approach is to use a dedicated microprocessor for SCSI bus control, communicating with the host memory through high-speed DMA channels. SCSI controllers are mounted on each peripheral, drawing their power supply from the peripheral rather than from the SCSI cable.

System performance with SCSI is high. It currently has a 1.5Mbyte per second maximum data rate, which may increase in the future. But in addition to the raw performance figures, SCSI includes numerous provisions to reduce the error rate. Data-bus parity provides the first level of protection for all transmissions, and an optional differential bus driver feature offers extra protection. To handle the few errors that do occur, SCSI provides extensive error identification and recovery procedures.

By decoupling peripherals from the system, SCSI removes a heavy burden from the system seller. Its widespread adoption would mean that retailers could sell peripheral products in knowledge that there will be no severe interface problems.

For the system seller, SCSI solves the central issue of reconfiguration. Using the Device ID command after any system reset the computer interrogates every address on the SCSI bus to determine what device, if any, resides there. The device responds with a complete description of the functional characteristics of its peripherals. Knowing the characteristics of the peripherals that are currently available, the OS can configure the system for optimum performance.

Ultimately, users may be the biggest beneficiaries from the adoption of SCSI as the standard peripheral interface. With SCSI, the peripherals become as personal as the personal computer itself. Most of the user benefits arise from SCSI's ability to personalise the peripherals. They include: convenient expansion with sealed-system peripherals; independence from peripheral developments; lower acquisition costs; less down time; and better fault isolation.

Computer products are increasingly being sold as sealed boxes so that manufacturers can offer a proper warranty. But with a sealed box, how does the user add peripherals and interface cards? SCSI offers a solution. Eventually, peripheral systems could have two plugs: SCSI In and SCSI Out. The user would simply purchase individual lengths of 50-element ribbon cable, along with any additional peripherals.

Having gained a new independence from peripheral developments, the user will no longer tend to wait for that new, improved system which always seems to be just around the corner. With SCSI, the user is at least guaranteed compatibility with new peripherals. An SCSI buyers' guide, published by Adaptive Data and Energy Systems of California, is available in the U.K. from Ambar Systems Ltd, Rabans Close, Aylesbury, Bucks HP19 3RS. Telephone: (0296) 34602.

Down time, too, will decrease because of the higher volume. But SCSI reduces down time even further by providing replaceable modules. The user simply unplugs the failed peripheral, then reboots the system. The computer reconfigures itself to the reduced configuration, while the user has the peripheral repaired or replaced.

Intelligent controllers

Faults are more easily isolated because the intelligent SCSI controllers take over this task from the operating system. Each SCSI controller includes the correct self-tests embedded in its own firmware. It reports any failure to the OS, using the Message capability of the SCSI command set.

Thus, for the end-user, the benefits of SCSI add up to an increase in convenience, usefulness and reliability — all at a significantly lower cost.

The impact of SCSI can extend far beyond mere hardware or software modifications. This new standard is part of a more general trend towards consumer-orientated computing. Such a trend is by no means unfamiliar in the evolution of high technology. Both the telephone and the stereo system became consumer products not long after their initial introduction. Admittedly, computers are more versatile, and hence more difficult to package as consumer products. They still have a long way to go, but to this end, the advent to SCSI is a major step. Its subsequent adoption will be truly a giant leap forward. PC

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STARdataBASE . . .

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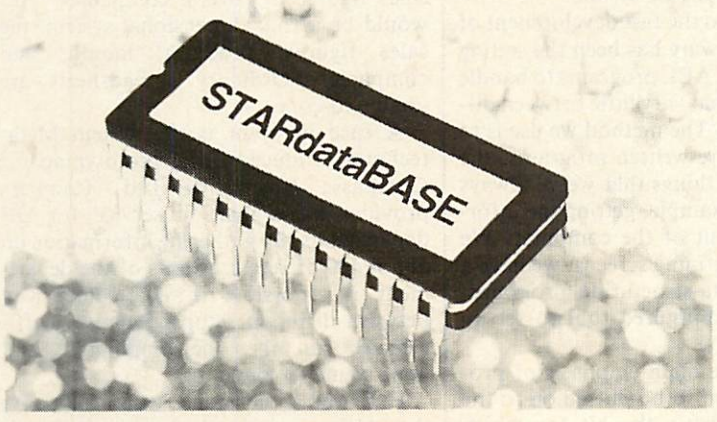

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Halfway house

The interactive nature of APL provides the basis of Metatechnics Systems' software prototyping service. Glyn Moody explains how.

THERE IS a dilemma facing purchasers of applications software. You may be able to buy a standard package that is reasonably well tried and tested; it is often quite cheap, but fails to match your requirements exactly. Subsequent patching may produce equally patchy results. Alternatively you can commission a software house to produce a one-off program. This may or may not eventually correspond to your own original vision: and there are plenty of horror stories of the slip-ups that can occur. In any case, you are likely to have to pay quite handsomely for your software.

The rather grandly named program generators might seem to be a way out of this impasse. Normally, though, their range of application is limited, and the level of customisation is strictly circumscribed. What is needed is some compromise between the alternative approaches that combines speed and ease of development with a close response to the user's needs.

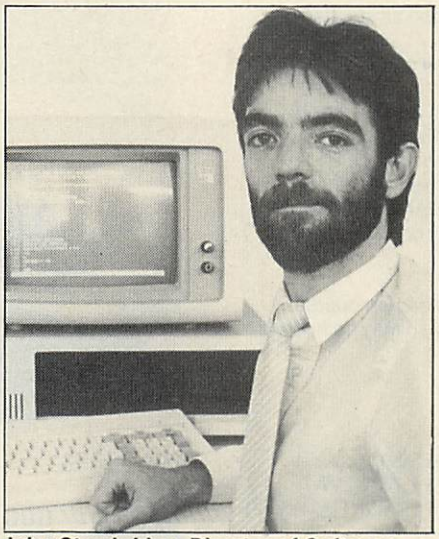
Metatechnics Systems Ltd would claim to have come up with this in its prototyping system. "We fit in somewhere between bespoke software producers and packages like Sycero," says John Stembridge, Metatechnics' director of software.

User-driven

The foundations for prototyping were laid in Stembridge's earlier experience of writing multi-dimensional modelling packages in APL. "The key to all these types of systems is that they are user-driven," says Stembridge. "We sit down with the user and talk to them about what it is they are trying to do, and what their job is. Within a short time you get an initial idea, so you can put something together relatively quickly."

This is possible because of the nature of the APL language, which is interactive and interpreted. "You're working in a very flexible environment where you can just sit at the computer and use it like a desk calculator." First efforts at programs can be patched together quickly. "It's very easy to set up a relatively simple system which reflects quite accurately what the user's initial requirements are," says Stembridge.

The next phase is iterative. "Once the user can actually see something on the screen, he can say 'Yeah, that's great, it's exactly what I wanted, but could we have this and this?' It sparks off ideas." Working from these ideas a second version of the software is produced and shown to the client. This process is repeated as many times as necessary.



John Stembridge, Director of Software, Metatechnics Systems Ltd.

One problem with commissioning software is that you need to know what you want before you can get it. Under this kind of prototyping method the final system evolves organically. The successive versions are valuable because they indicate progressively what is possible and what additions a user can ask for. As John Stembridge says, "Quite a lot of people are computer-naive: they've never really sat down with a programmer or analyst to discuss how to design a system."

A further aid to the fast development of applications software has been the setting up of a library of APL programs to handle basic functions that vary little between different projects. "The method we use is to create a lot of pre-written programs, the common sort of things that we've always had to do. For example, getting the information in and out of the computer. We have means of defining screens; we have a whole set of data-structuring programs; we have a pre-configured tool to set up reports."

This allows the main emphasis of program development to be shifted on to the calculations. "That's the bit for which APL is most specifically suited," says Stembridge. Typically these utilities will make up half the final program, which itself takes up about 90K. "90K is actually quite a lot of APL," says Stembridge.

The version of APL used is APL Plus. About 115K is needed for the interpreter. This leaves about 300K for the program on a 512K IBM PC. Working on a machine with less than this is not really practical. "If you're using APL, the more memory the better."

Not all of the finished application program is written in APL. "There is C and assembler mixed in," says Stembridge. "The reason is that the IBM PC is not that powerful when you are running an interpreted language like APL. Even though APL Plus is a good version and very efficient, there are some operations which take up a lot of time." The solution is to create a small assembler or C program to carry out those operations much more efficiently. This is another advantage of APL. It allows you to access and run such programs just like any other APL function.

The size of the interpreter and problems of speed are two of the slight disadvantages of APL. But this is more than made up for by the language's power of arithmetical manipulation. Some of these were touched on in the review of Micro-APL in the February issue of *Practical Computing*. This ability makes it ideal for number-crunching activities and financial-modelling applications.

Multi-dimensional

As Stembridge says, "APL's major strength is that it is multi-dimensional. It handles large numbers of dimensions in a very logical and consistent manner." In a financial model you might be dealing with sales figures of several companies. This would be a four-dimensional system: the sales figures, products, months and companies. Ordinary spreadsheets are unable to cope.

A case in point is the system Metatechnics produced using prototyping for Compasss Consulting Ltd. Compass provides an evaluation service for DP departments. By gathering information on about 400 different aspects of the department, it is possible to make comparison between different setups. Relative inefficiencies can then be pinpointed, and improvements made.

Here the dimensions were: company; the various aspects that were measured; the years; and cases, which took the form of generalised What-If? questions. Out of the many areas covered by the Compass analysis, several were taken and progressively altered to investigate the overall effect on the DP department's relative efficiency. These cases correspond to a

further dimension of freedom that needs to be allowed for in the software.

The complexity of the analysis provided by Compass meant that it was ideally suited to coding in APL. It also meant that it was a nighmare to use conventional spreadsheet methods, the technique employed before the new system was written. "We went to see this guy, and he actually had an IBM PC and a big pile of floppy discs. He was tearing his hair out trying to get some of the data on this disc and some on this disc, and compare it to produce reports. He couldn't get all the data he needed in the one place at the one time," says Stembridge.

The client had come across APL: "He'd clicked immediately it was multi-dimensional and was very suitable," says Stembridge. Initially the client had planned learning APL himself and buying some of the APL library routines produced by Metatechnics. Stembridge says they managed to persuade him to allow them to put forward a proposal, which would consist of a program together with a more detailed proposal.

"About three days later I went back to him with a skeleton system, which basically has most of the control screens, a few of the output screens, and used random numbers. It did quite a lot of the things he wanted it to do, just on random numbers," says Stembridge.

The technique of interactive prototyping proved invaluable. "A lot of questions came out of actually seeing something on the screen, being able to say 'this is what I actually wanted'. We took it from there."

The process continued as Stembridge incorporated into the system what he had learnt from further discussions with Compass. "Within about four weeks he had a complete new system, which was already giving him more than he had before." The interactive nature of prototyping meant that there was a close liaison between the software house and the client. "In the first month we had about seven or eight meetings of varying lengths. A lot of it can be done over the telephone."

Since then, further work has been done developing the What-If? side, and a number of other refinements have been added. One is a function called Analyze, which allows you to interrogate the system and delve into the analysis of your DP department's data. An innovation stemming from this is the use of floppy discs sent out with the reports. "What they used to get was just bound, printed reports. What they are getting now is that plus a floppy disc with all their data on it and the Analyze program. So they can actually go inside and look at these thing interactively and find out how these numbers are made up."

Similarly, data is collected on a floppy disc. "We have a small Basic program which we wrote to capture the information. It validates what they enter and makes sure it is sensible," says Stembridge.

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Special Instructions:

An output screen of one of Metatechnics' APL library routines.

Name	Start	Size	Type	Attr
DATE	1 59	1 19	OUT	NORMAL
CNAME	3 7	1 33	IN/OUT	NORMAL
ADDRES	4 10	3 30	IN/OUT	NORMAL
DELIV	3 52	4 26	IN/OUT	NORMAL
ORDER	7 11	1 11	IN/OUT	NORMAL
PER	7 27	1 12	IN/OUT	NORMAL
TERMS	7 46	1 11	IN/OUT	NORMAL
PHONE	7 64	1 14	IN/OUT	NORMAL
NLEN	12 1	7 7	NUM	NORMAL
LENGTH	12 9	7 6	NUM	NORMAL
METRES	12 16	7 6	NUM	NORMAL
SECTN	12 23	7 7	IN/OUT	NORMAL
DESC	12 44	7 11	IN/OUT	NORMAL
PRICE	12 56	7 10	NUM	NORMAL
PORM	12 67	7 1	IN/OUT	NORMAL
CORE	12 69	7 1	IN/OUT	NORMAL
DDATE	12 71	7 8	NUM	NORMAL
SIZE	12 31	7 12	IN/OUT	NORMAL
INSTR	20 23	2 55	IN/OUT	NORMAL
ERROR	23 0	1 80	OUT	HIGHLIGHT
HELP	24 0	1 80	OUT	NORMAL

The parameters of the form can be altered to customise it for a particular application.

15:16 6th Mar 1985 COMPASS Evaluation System System Menu

1. Select
2. Reports
3. Analyze
4. Globals
5. Simulate
6. Print
7. End

Select Option: 7 Items

F1-Help F9-Quit

The opening menu of the tailor-made Compass Evaluation System.

The cost of the prototyping is made up of two parts. The standard routines from the APL library are included for a fixed sum of £395. Thereafter the charge is on a time and materials basis. The daily rate varies between £150 and £200. The final cost for the Compass system will be about £10,000. As Stembridge points out, "We could have stopped after a month, in which case it would have cost about £3,000."

It is hard to compare this with the cost of commissioning bespoke software. Stembridge sees the advantages more in terms of speed of development. "Developing line for line, comparing APL with other languages, the ratio is somewhere between four and 20 to one." The main thing is, the clients seem happy enough. Prototyping could well do the same for others looking for personalised modelling systems that can be developed quickly. Further information can be obtained from Metatechnics Systems Ltd, Unit 216, 62 Tritton Road, London SE21 8DE. Telephone: 01-670 7959. PC

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Nine Men's Morris

The playing algorithm for this game is straightforward enough to make even a Basic program a worthy opponent. David Levy offers some suggestions on how to proceed.

THIS GAME for two players has been popular as far back as the middle ages and is variously known under other names, such as Mill, Morelles or Muhle. Today it is probably most played in Germany, though game shops in Britain usually have Nine Men's Morris boards for sale.

The game is played on a specially marked-out board that has three concentric squares. There are points marked at the corners of the three squares, and at the middle of each edge of each square — 24 points in all.

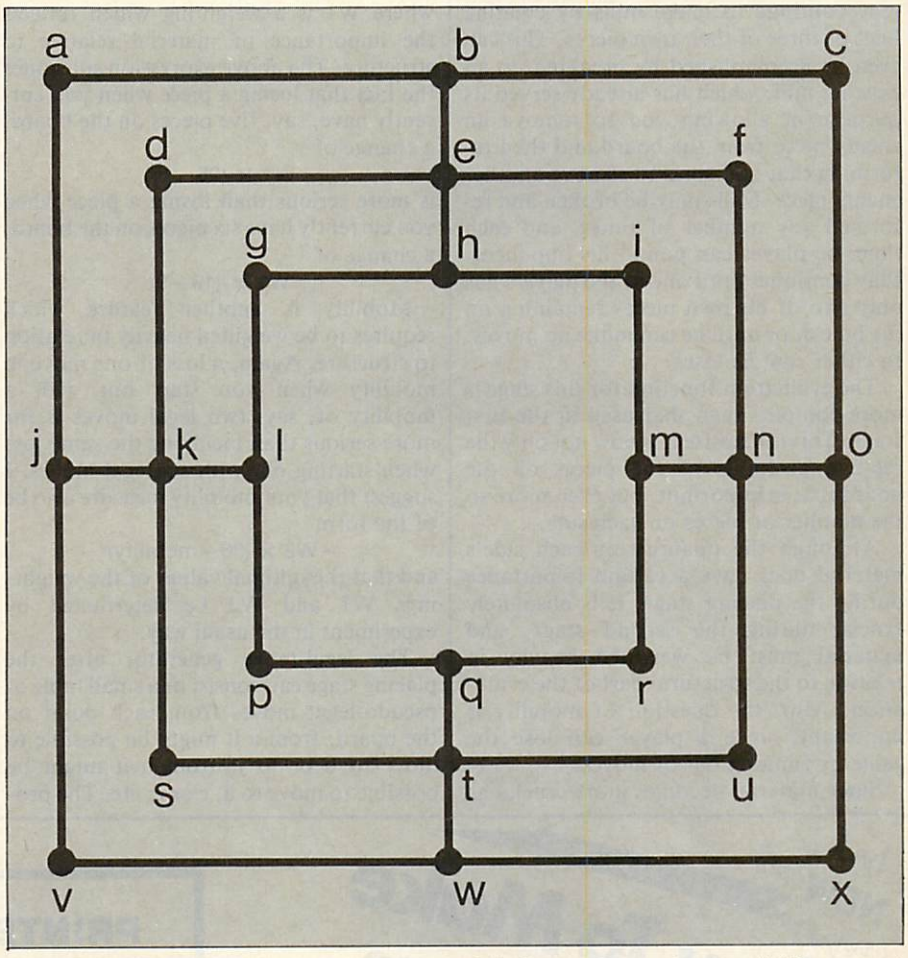
At the beginning of the game the board is empty and each player has nine pieces; you can use nine white and nine black draughts pieces or anything similar. The object of the game is either to capture all but two of your opponent's pieces, or to prevent your opponent from making any moves.

There are usually three stages of play but the third stage can be omitted. At the start of the game the first player puts one of his pieces on any of the 24 points of the board. The players then alternate, each move by a player consisting of placing one of his own pieces on a vacant point. During this stage each player tries to get three of his own pieces in a straight line, such as on points a, b and c, or on points b, e and h. When he has achieved this a player is said to have formed a mill.

Once he has formed a mill, a player may pound his opponent by removing any one of his opponent's pieces from the board; it is not permitted to remove a piece which forms part of an opponent's mill unless there is no other piece which can be removed. Once a piece has been removed from the board it stays off, and performs no function during the rest of the game.

Line contains		
White pieces	Black pieces	Variable
0	0	0
1	0	1
2	0	2
3	0	3
0	1	4
0	2	5
0	3	6
1	1	7
2	1	8
1	2	9

Table 1. Value of variable for all possible configurations in a single line.



Nine Men's Morris board.

This stage of the game continues until each player has placed each of his nine pieces on the board. Obviously your evaluation function for this stage needs to be designed to do two things. First, it should encourage your program to place its own pieces in such a way as to maximise its own chances of forming a mill. Secondly, it should make the program attempt to interfere with the user's own piece formation.

In order to speed up position evaluation, I suggest that you create a separate variable for every one of the 16 possible ways in which a mill can be created: abc, def, ghi, jkl, mno, pqr, stu, vwx, ajv, dks, glp, beh, qtw, imr, fnu, cox. Each of these variables can take a different value depending on the configuration currently in that line, as shown in table 1.

This set of variables can be duplicated for each ply in the game tree. Whenever a move is generated the program can determine which of the lines is affected by that move and can update the relevant variables for that line.

There is no need for the program to waste time updating information which it knows has not changed. For example, if a player places one of his pieces on point a, the program knows that it does not need to update the variable corresponding to the def line, since that variable cannot possibly have changed.

Associated with each variable value there is a score component, and by adding together the components for a player the program produces a score for the structure of a position. You will need to experiment in order to find the optimal values for the various configurations, but common sense can provide some sensible starting values. I would suggest something like table 2.

Once both players have placed all nine of their pieces, the method of making moves changes. A move now consists of moving a piece from its present location to any vacant point immediately adjacent to it. For example, a piece on point a can move to b or to j, provided that these

(continued on next page)

Variable	White's score
0	0
1	1
2	4
3	9
4	−1
5	−4
6	−9
7	0
8	2
9	−2

Table 2. Suggested scoring values for each value of the variable.

(continued from previous page)
points are vacant; a piece on the e point can move to b, d, f or h, again provided that they are vacant.

During this stage of the game players may continue to make mills by creating lines of three of their own pieces. This can even be accomplished by breaking up an existing mill, which has already served its purpose in allowing you to remove an enemy piece from the board and then re-forming that mill so as to remove another enemy piece. Mills may be broken and re-formed any number of times, and each time the player can pound his opponent. Play continues until one of the players has only two of his own pieces remaining on the board, or until he can make no moves. In either case he loses.

The evaluation function for this stage is more complex than that used in the first stage. This is because it is now not only the relative positions of the pieces on the board that is important, but even more so the number of pieces on each side.

Although the quantity of each side's material does have a certain importance during the placing stage, it is absolutely crucial during the second stage, and material must be weighted heavily in relation to the structural part of the evaluation. Also, the question of mobility is important, since a player can lose the game by running out of moves.

Since material becomes more crucial as each player has fewer and fewer pieces on the board, I would suggest using some sort of quadratic measure for material. You can try starting with

$$-W1 \times (\text{pieces lost})^2$$

where W1 is a weighting which reflects the importance of material relative to structure. The above expression subsumes the fact that losing a piece when you currently have, say, five pieces on the board, a change of

$$W1 \times (25 - 16)$$

is more serious than losing a piece when you currently have six pieces on the board, a change of

$$W1 \times (16 - 9)$$

Mobility is another feature which requires to be weighted heavily in relation to structure. Again, a loss of one move in mobility when you start out with a mobility of, say, two legal moves is far more serious than incurring the same loss when starting out with six legal moves. I suggest that your mobility measure also be of the form

$$-W2 \times (36 - \text{mobility})^2$$

and that the optimal values of the weightings W1 and W2 be determined by experiment in the usual way.

The legal-move generator after the placing stage can consist of a small table of pseudo-legal moves from each point on the board: from a it might be possible to move to b or to j; from b it might be possible to move to a, c or e; etc. The program simply addresses the table entries corresponding to each point on the board which is occupied by a piece of the appropriate colour. If the point indicated by the corresponding table entry is vacant, then it knows that the move is legal.

The branching factor will normally be rather low. During the moving stage most of the pieces on the board will have their mobility limited by other pieces, and when this is no longer true the remaining pieces will be fewer in number. I would expect a branching factor in the range 4 to 15 for most of the game. This, taken in conjunction with the simplicity of the evaluation function, suggests that your program's tree search might be able to achieve depths of 10 ply or 12 ply, or even more, if you write in assembler. Even Basic programs ought to be capable of searching to a depth of four ply or six ply within an acceptable time.

For the sake of completeness I ought to mention the optional stage of the game. I suggest that you do not program this stage, because it makes the game more of a lottery and less of a battle of skill.

When either player has only three pieces remaining, he is no longer restricted to moving a man to an adjacent point. Instead he is allowed to hop to any vacant point on the board. This freedom of movement gives him an advantage which is sufficient to restore his chances of winning from a hopeless situation. PC

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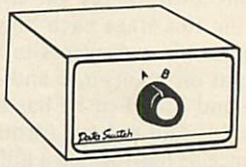
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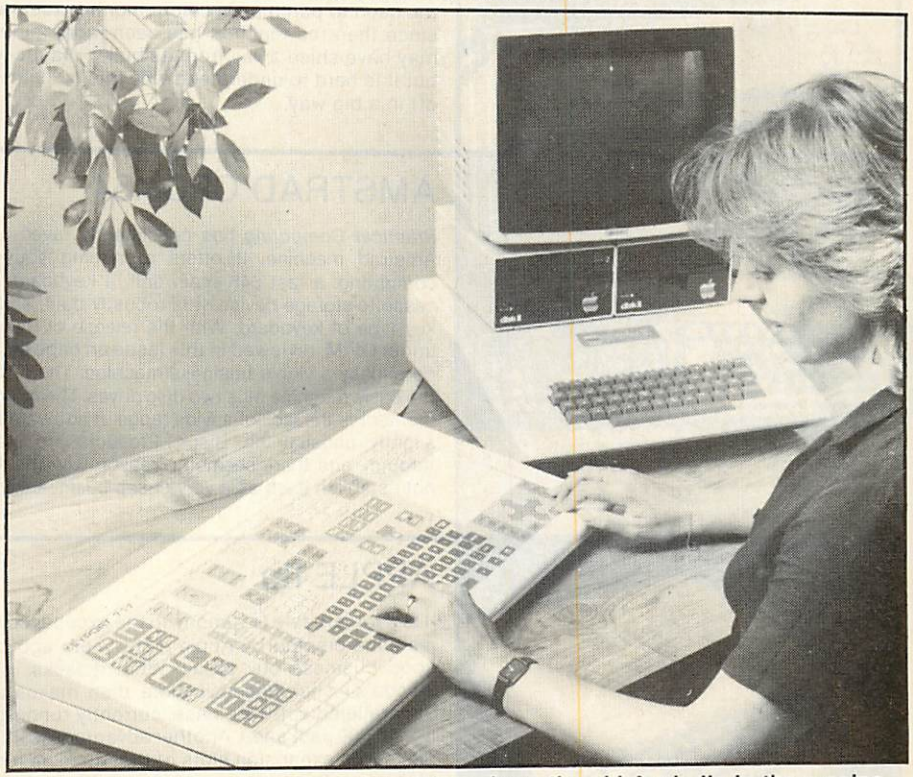


Hardware add-ons and a huge software base keep the old Apple IIe in the running.

BUSINESS normally buys the best it can at the lowest possible price. The home-computer enthusiast may allow him or herself to be seduced by the latest bell and whistle to buy way beyond the machine they need for present applications; at worst, this can mean sardines on toast for a few months. But for businesses, computer acquisition is, or at least should be, a far more serious matter, and one where price and performance need to be tailored specifically to the task in hand.

A further constraint is that, unlike the home user who can probably make do if the keyboard is unsatisfactory and the program rather slow to load, the professional requires certain minimum capabilities below which the machine will be useless. For example, if it is quicker to look up a client account manually than to use a computer, the system will never catch on. It is even worse if a machine is not totally reliable, or the integrity of its data cannot be guaranteed.

For these reasons, the beguiling cheap home machines are mostly non-starters when it comes to business use. For example, the QL seems well suited to small-scale business applications in most respects, but is let down by its Microdrives. Despite Sinclair's soothing noises, they are still insufficiently reliable to be entrusted with valuable business information. It remains to be seen whether the Atari ST will live up to its specification as a quantum leap beyond the QL, and provide a near-Macintosh capability for a fraction of the price.

Other home machines like the BBC Micro can be made into business systems by bolting on disc drives and a Z-80 second processor to enable them to run CP/M, but by then they are hardly budget systems, given their eight-bit technology. The only machine we have included from this class is the Amstrad CPC-464, which offers CP/M capability for a little over £500 plus VAT.

Most budget business systems have a miniumum specification of a 16-bit processor, one or two disc drives, a moving-key type of keyboard, and the ability to run MS-DOS or CP/M. Among the exceptions to this rule are the Commodore 8296D, which has old technology but an impressively capacious 2Mbyte floppy. And the trusty Apple IIe has so much general and specialised software that it is well worth considering for small-scale or particular applications.

A number of machines hovering around the £1,000 price are what is normally classed as portable or transportable. Although no preference has been given to machines which offer this additional feature, it may be relevant. In addition to the Kaypro and the Osborne, the battery-powered Epson PX-8 is in this price bracket, and its total portability may well make it ideal for some jobs. Battery portables were surveyed in last month's *Practical Computing*.

Although businesses are concerned with saving money, in computer purchases, as elsewhere, the distinction between short- and long-term savings should be made. In their own way the machines described on the following pages are all budget systems offering various flavours of business computing for around £1,000. But the degree to which they will remain viable machines in the years to come, and to what extent they could form part of a coherent growth plan, differs widely. For example, only the Apricot F1 is part of a complete family of machines that will extend up to a local area network of 32 micros. On the other hand, the Tandy 1000 offers the possibility of tying in with the ever-growing IBM software base. Provided later machines are also IBM or compatibles, the software and files will carry across.

If you think you will eventually require more than a budget system anyway, it is probably better to formulate an overall business-micro acquisition policy from the start. However cost-effective an individual piecemeal purchase may be it rarely pays off in the long run. The end result is normally a botched system rather than a budget one. PC

Suppliers

Advance 86B: Advance Technology (U.K.) Ltd, 8A Hornsey Street, London N7 8HR. Telephone: 01-609 0061

Amstrad CPC-464: Amstrad, 169 Kings Road, Brentwood, Essex CM14 4EF. Telephone: (0277) 228888

Apple IIe: Apple Computer (U.K.) Ltd, Eastman Way, Hemel Hempstead, Hertfordshire HP2 7HQ. Telephone: (0442) 60244

Apricot F1: ACT plc, 111 Hagley Road, Birmingham B16 8LB. Telephone: 021-454 8585

Commodore 8296D: CBM U.K. Ltd, 1 Hunter's Road, Weldon, Corby, Northamptonshire NN17 1QX. Telephone: (0536) 205252

Kaypro: Kaypro U.K. Ltd, Elm House, 19 Elmshott Lane, Cippenham, Berkshire SL1 5QS. Telephone: (06282) 67344

Osborne: Future Management (Portable Computers) Ltd, 38 Tanners Drive, Blakelands, Milton Keynes MK14 5LL. Telephone: (0908) 615274

RM Nimbus: Research Machines Ltd, Mill Steet, Botley Road, Oxford OX2 0BQ. Telephone: (0865) 249866

Sanyo 555: Sanyo Marubeni (U.K.) Ltd, Sanyo House, 8 Greycaine Road, Watford, Hertfordshire. Telephone: (0923) 46363

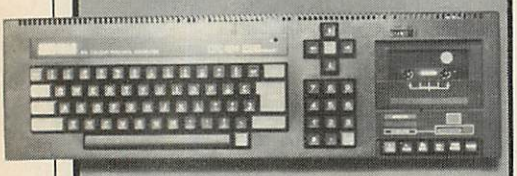
Tandy 1000: Tandy Corporation (U.K.), Tameway Tower, Bridge Street, Walsall, West Midlands WS1 1LA. Telephone:. (0922) 648181

ADVANCE 86B £1,086

When the Advance was launched in the middle of last year, its specifications seemed remarkable. For £1,086 it offered a full 8086 processor, 128K RAM, two 360K 5.25in. floppies and four bundled software packages: a word processor, spreadsheet, database and spelling checker. The price also includes a 12-month on-site servicing warranty. The clincher was its high degree of IBM compatibility. The only problem is the need to purchase a colour monitor separately. However, since then the reaction has been more muted. Businesses may have shied away from its bulky, plastic-looking casing, but it is hard to understand why this machine has not taken off in a big way.

For. IBM compatibility. Bundled software. Maintenance warranty.

Against. Bulky design. Not yet established. Monitor not included in price.



AMSTRAD CPC-464 £519

Practical Computing has consistently raved about the basic Amstrad machine. It offers everything you need to begin computing: a fast 64K main unit, a keyboard, monitor, and a cassette-storage device. It is robustly built, and has a moving-key type of keyboard. With the release of disc drives running under CP/M, reviewed in this issue on page 86, the Amstrad is potentially a viable business machine. The price quoted is for the basic machine plus two disc drives. The main problem at the moment is the lack of a wide range of software available on the slightly unusual 3in. discs. Products are starting to come through, and there seems no reason why the Amstrad should not establish itself as a very cheap business system.

For. Price. Neat design.

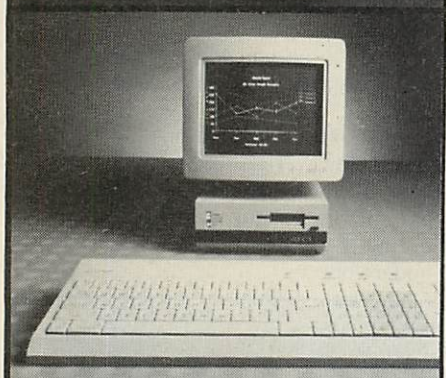
Against. Lack of software. Home-computer origins.

APPLE IIe £1,095

It is a remarkable testimony to the excellence of the hobbyist machine created by Apple eight years ago that it is still a good business buy today. What it lacks in sophisticated silicon or slick speed it more than makes up for with its unparalleled software base, currently running at something like 10,000 packages. Another advantage is its expandability. The seven expansion slots of the Apple IIe mean that a host of third-party add-ons can transform the machine into a very specialised tool for particular fields. The main problem with the Apple IIe is the limited disc storage of only 143K per drive. The quoted price is for the Apple IIe with 64K RAM, twin disc drives, 80-column card and green-screen monitor.

For. Software base. Expandability.

Against. Limited disc capacity. Slow.



APRICOT F1 £1,295

The Apricot F1 offers a 16-bit machine running under MS-DOS, with 256K RAM, colour circuitry as standard, and four bundled packages. The price quoted includes a colour monitor. The single 3.5in. floppy holds a healthy 720K, and the keyboard communicates with the main unit via an infra-red link. There is the option for an infrared mouse/trackball. Included in the bundled software is an icon-driven front end which lets you carry out operations like formatting and copying discs without the need for explicit typed-in commands. The F1 forms the entry-level system to the entire Apricot range, so any Apricot software will run on the F1 and vice versa. Other models in the range include the Apricot PC and the Portable, both costing £1,795.

For. Colour. High-capacity disc.

Against. Shallow keyboard. Not very portable.

COMMODORE 8296 £1,470

The Commodore 8000 series has developed from one of the first business micros on the market. The large user base has meant that programs are still available for them, and Commodore is naturally keen to cater for this market. Thus last year it launched two new machines in the range, the 8296 and the 8296D. They are compatible with the whole range of 8000 software, but offer considerably more in terms of hardware. Based on the 6502, they come with 128K RAM and an integral 80-column by 25-row green-phosphor screen. Additionally the 8296D offers a built-in 2Mbyte floppy. Like the earlier machines in the series, the 8296D uses Commodore's Basic 4.0, has a detachable keyboard, and comes with bundled software.

For. Base of Commodore business software. High-capacity floppy.

Against. Old technology. No access to recent popular programs.

Top 10: Budget systems

KAYPRO £1,116

The Kaypro is designed as a mains-powered transportable machine, though its bulk and 26lb. weight put it in the luggable class. But its price and the full range of bundled software mean that anyone undisturbed by its very functional and inelegant looks could find it a perfect budget business system. Among the packages included are CP/M 2.2, WordStar, Mailmerge, Calcstar, dBase II and Microsoft Basic. The basic machine offers a Z-80A, with 64K RAM and twin discs. The Kaypro II has two 191K 5.25in. floppies and costs £1,116; the £1,551 Kaypro IIX has two 392K drives, and the Kaypro 10 costs £2,548 and has a 10Mybte Winchester and one 392K floppy. Apart from its looks, the machine's main drawback is its over-sensitive keyboard.

For. Bundled software. Various disc format capabilities.

Against. Over-sensitive keyboard. Inelegant looks.

OSBORNE 1 £745

Industry personality Adam Osborne was the first person to formulate the idea of a machine that offered all the facilities required in a business system together with a range of bundled software. His machine, the Osborne 1, came with WordStar and Supercalc as well as CP/M 2.2 to run on its eight-bit Z-80A processor. The packaging of the hardware was innovative when it was first announced, but now looks somewhat dated. In particular, its 5in. screen can cause eyestrain. The 200K disc drives seem rather parsimonious, though you can upgrade them to 400K for an extra £495. Older versions of the machine offered only 52 columns but the latest models have 80 columns as standard.

For. Nice idea. Good bundled software.

Against. Small screen. Low-capacity discs.

RM NIMBUS £1,695

Research Machines is best known for its two long-serving educational machines, the 380Z and 480Z. Recently it produced an impressive machine at an even more impressive price that is perfectly viable as a purely business system. The Nimbus uses an advanced 80186 chip, which lends it fast response times coupled with a degree of IBM compatibility. Adding a special graphics chip puts this speed to spectacular use in drawing colour screens faster than just about any comparable micro. In overall terms, the Nimbus is as fast as the IBM PC/AT, which in turn is more than twice as fast as the IBM PC. For a firm that wants a business machine with powerful graphics at a budget price, the Nimbus is in a class of its own.

For. Brilliant graphics. Fast machine.

Against. Not full IBM compatibility. Not exclusively a business machine.

SANYO 555 £1,325

The Sanyo 550 and 555 are aimed precisely at businesses requiring a cheap system. They are straight MS-DOS machines — not IBM compatible as is sometimes claimed — and run a straight 8088 processor. Standard RAM is 128K which can be upgraded to 256K. There is 8K of ROM. Disc options start at one 160K for the 550 and two 160K for the 555. There is also a 320K upgrade available. The 12in. monitor is monochrome but full-colour circuitry is included as standard. The 81-key detached keyboard has 10 programmable function keys. A Centronics parallel port is included, but serial ports are extra. The bundled software includes WordStar, Calcstar, Planstar and Mailmerge, as well as an accounting package.

For. Bundled software. Colour circuitry.

Against. Small floppies. No serial port.

TANDY 1000 £1,600

The Tandy 1000 offers a full-colour machine with a high degree of IBM compatibility for just under £1,600. It comes with 128K RAM expandable to 640K, and with a 360K disc drive. A second disc drive costs a further £269. Compatibility extends to the three expansion slots except that they are too small to take standard IBM versions. The keyboard is of good quality but differs from the IBM offering — one advantage of this is that the Backslash key has been moved somewhere more sensible. The Tandy is also largely compatible with the PC Junior, which constitutes IBM's attempt to break into the living room as the office. A big plus for the Tandy 1000 is its bundled integrated software, reviewed on page 82 of this issue.

For. IBM compatibility. Colour.

Against. Non-standard expansion slots. No serial port.

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C. ITOH: N — £3.79.
DIABLO Hi-type II: MS — £1.79; N — £2.79*
EPSON MX80: N — £2.79* Refill — £1.88. EPSON MX100: N — £3.47; Refill — £2.49;
EPSON LQ1500: N — £3.55.
IBM 82: SS — £1.29, SC — £0.99*; HC — £1.99; MS — £2.19.
IBM DAISYWRITER: MS — £4.39.
JUKI 6100: SS — £1.29; SC — £0.99*; HC — £1.99; MS — £2.19.
MANNESMAN TALLY MT80: MS — £2.64; N — £2.79. MT100: N — £3.95.
NAKAJIMA: SC — £2.99.
NEC SPINWRITER: 5500-MS-£2.09; N — £3.49; 3500 — N — £3.89*
OKI MICROLINE: 82 — N — £1.09: 84 — N — £2.49.
OLIVETTI ET121; SS — £2.89; SC — £1.79*; N — £3.41.
OLYMPIA ES100: SS — £2.59; SC — £1.99*; N — £2.79.
RICOH 1600/1300: MS — £2.69.
QUME 3/5: MS — £1.59*; QUICKLOAD — £2.19*.
QUME 3/5: MS — £1.59*; QUICKLOAD — £2.19*.
QUME 7/9 & IV: MS — £3.19*; N — £3.55.
SEIKOSHA GP80: N — £2.00.
SHINWA CP80: MS — £2.64; N — £2.79.
SILVER REED EX 42: SC — £2.09. SILVER REED EXD15: TH — £2.68.
SMITH CORONAMATIC EL2000; SC — £2.63*; MS — £4.84; N — £2.50.
STAR RADIX 10: N — £4.16: STAR RADIX 15: N — £4.99.
TELEX: PUMA — £1.39. CHEETAH — £13.49.
TRIUMPH ADLER GABRIELLE: SC — £2.99; MS — £3.99.
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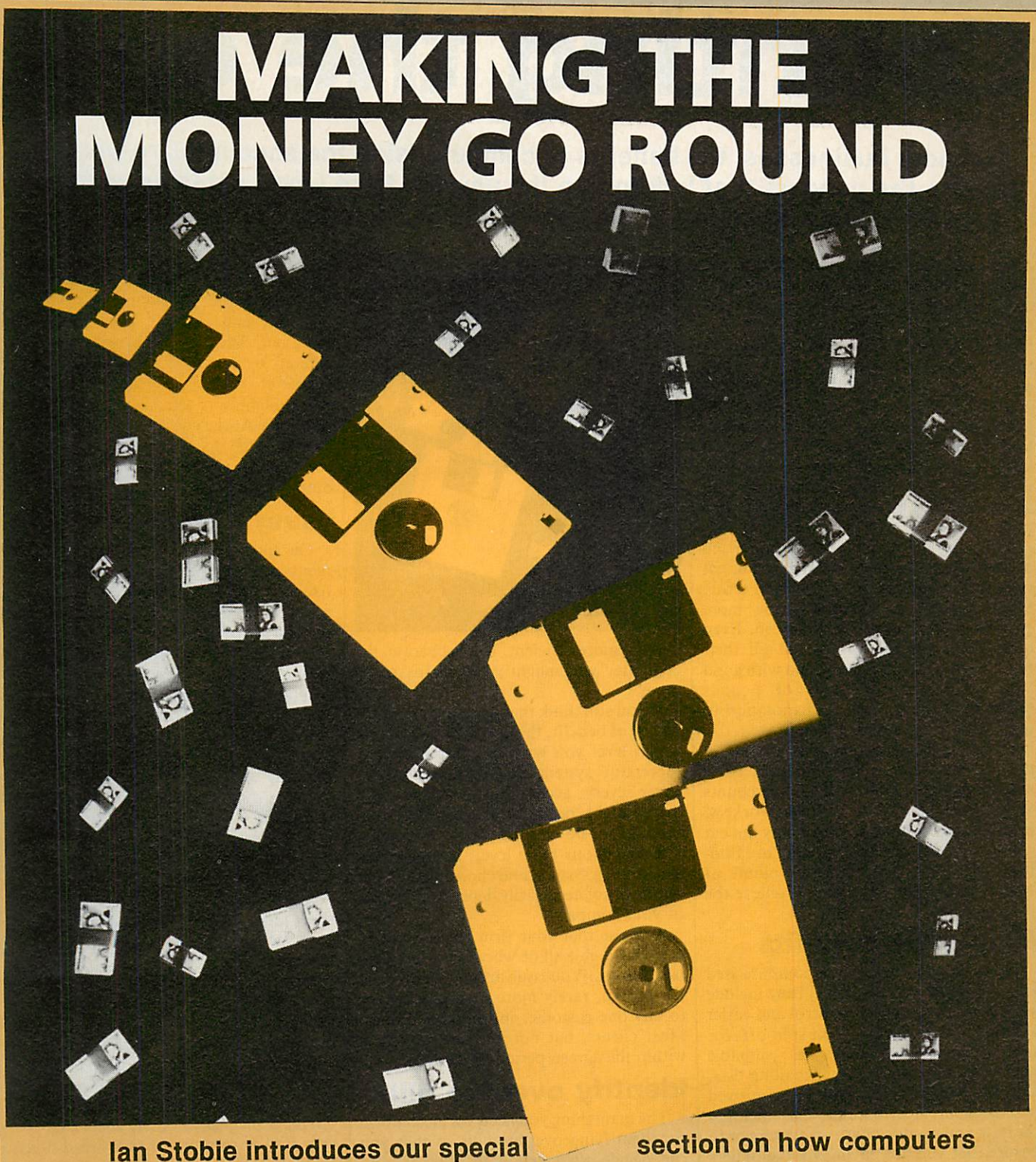


Ian Stobie introduces our special section on how computers can be used to organise the finances of your business.

COMPUTERS can do much more in business than just ape existing manual systems. Once the right information is held on a computerised system the opportunity exists for better-informed decision making and closer financial control. In this 11-page special feature we look realistically at what you can do with everything from a spreadsheet package to a full-blown integrated accounting suite.

Undoubtedly, making the right use of computers can bring enormous benefits, but it is not a good idea to overlook risks. Computerising the accounting function is probably the most dangerous thing you can do with a computer, since accurate and up-to-date accounts are essential for the survival of any business.

In the first part of this feature we concentrate on telling you what you need to know to separate the good from the bad. We distinguish between the different types of accounting software on the market and provide a detailed check list to help you evaluate the packages that seem to meet your needs. We than take a look at one of the most widely available integrated personal-computer ledger systems on the market to see how it measures up against our criteria.

We also cover two important new developments in financial software. The latest generation of machines such as the Macintosh and the IBM PC have very good graphics. On page 116 Chris Bidmead looks at what effect this is having on the way accounting is tackled on computers. And beginning on page 118 Glyn Moody details the range of financial services which are available down the phone to anyone with a personal computer and a modem. PC

Counting the cost

For most businesses, the benefits of computerising the accounts are worth it, despite the dangers that lurk to trap the unwary. Mike Lewis explains what you need to know to separate the good package, from the bad and the ugly.

COMPUTERISING the accounts department is one of the most perilous actions that most companies undertake. Get it right and you will enjoy greater control of your finances, higher profits, and perhaps even more time with your family. Get it wrong and the consequences will be dire. At best, you will face inconvenience and delays. At worst, you will fail to collect your debts, lose your credit rating, face resentful staff, and pick up an auditor's qualification on your annual accounts. In short, you will be another computer disaster story.

Yet the hazards of computerised accounting are easy to avoid, and doing it right is largely a matter of common sense. What is more, the exercise is now more cost-effective than it has ever been. Even quite large companies can put all their book-keeping on to micros, and with good software costing hundreds of pounds rather than thousands, the temptation to computerise can be hard to resist.

So is it really worth taking the risk? First the benefits: surprisingly, saving staff is not always one of them. If your accounts department has three full-time workers, installing a computer will probably not cut it to two. But if the existing staff are finding it hard to cope with the volume of work, a suitable system might relieve the pressure.

Intangible benefits

Most of the benefits of computerised accounting are less tangible. They include greater accuracy, better control and easier auditing. There might also be spin-offs for other departments, such as valuable marketing data or customer mailing lists. But the biggest gain will be improved management information. This includes the data you need to chase up debtors or to ensure that you are paying your suppliers at the best time, as well information to help you make strategic decisions: whether to offer better settlement discounts to improve cash flow, for example.

What the computer will not do is to provide a substitute for a book-keeper's expertise. Many a company director must have looked at a pile of invoices, payment reminders, VAT forms and PAYE documents and thought, "Why not just get a computer to sort it out?" Some hope! By the same token, nobody should ever expect a computer to create order or discipline. If you have an efficient accounts department, a computer will

make it more efficient. If it is chaotic, the computer will magnify the chaos many times.

If you still think that a computer system will be of benefit, the next step is to decide which level you wish to computerise. A successful system does not necessarily cover every accounting function, and there might be good reasons for continuing to do certain tasks manually. There are four basic levels at which you can install a system, and choosing the right one does not necessarily depend on the size of your company.

Suppose that your firm has around 50 customers, not all of whom provide regular business. You issue around 20 invoices per month, rarely more than one invoice to any one customer in the same month. Most clients, but not all, pay their bills within the agreed period of 28 days.

Identify overdue bills

The main thing you need is a mechanism for identifying overdue bills so that you can decide what action to take, if any. Also you will probably find it useful to know how well your firm is doing in its various activities, so some form of departmental analysis would be worthwhile. What you certainly do not need is a full sales ledger, not so much because of the low number of accounts, but because the majority of accounts would have fewer than two postings in any one accounting period.

One solution for a firm like this is simply to computerise its sales day book, which is an easy task with a good-quality spreadsheet program such as Supercalc or Multiplan. Figure 1 shows how it might look. You enter the invoice details along the rows of the spreadsheet. At the end of the period the program totals up the columns, and you can print the whole thing out. The date of payment would be entered by hand on the printout, so a glance at the relevant column would tell you straightaway which invoices were outstanding. At the end of every quarter you simply add up the totals from three consecutive sheets and you have your output figures for the VAT return.

Using a spreadsheet

On the purchases side, your requirements might be just as easy. Assume that, like many small companies, you allow the purchase invoices to pile up in a tray until the end of the month. You then sort them out, write the cheques, and send them off with compliment slips. A purchase ledger is unnecessary as you can control the matter through the cash book. Again, this can be set up as a spreadsheet. It can also help with the VAT returns and the monthly bank reconciliation.

Using a spreadsheet in this way is easy, cheap and flexible. You can get it running on the cheapest disc-based micros, including transportables and small desktop machines like the Kaypro 2 or the Apricot F1, both of which include spreadsheet programs in their price. So the total cost, including a modest printer, could be under £1,500.

However, this first level will not be able to cope with large volumes of book-keeping entries. So if your company issues more than, say, 75 invoices per month, you might have to move up to the next level of computerisation: a dedicated cash-book program.

The principles of such a package are very similar to those of the spreadsheets, except that the software is specially written for small business accounts, and does not need to be programmed by the user. You simply enter your invoices, cheques, petty-cash vouchers, etc., into forms displayed on the screen, using a fill-in-the-box technique. The program prints a limited number of analyses and reports, usually including a VAT return. The idea is similar to that used in the small traders' account books which you can buy from as a stationers.

Such programs are cheap and the total cost will only be a little more than with the first level. Also, the software will be able to handle higher volumes of data than

spreadsheets. But they still do not provide full ledger accounting.

Now consider the case of a business that issues a steady stream of invoices, often with several bills to the same customer in the same month and with many customers paying well after the end of the following month. Volumes are also high on the purchases side. With all this money flowing through the books, the financial director rightly wants to see a proper trial balance every month. A company in this position will find it hard to avoid a computerised ledger system.

At this third level the firm can opt for the "big three" accounting functions: sales, purchases and nominal. Many accounting packages offer these as separate, free-standing modules. You can choose to have all three sections working together or implement them one at a time.

The sales ledger is the most popular of the three because getting statements out on time is worth more than paying creditors promptly. Sales ledgers come in two flavours: open item and balance forward. In the latter, the customer's account is notionally ruled off at the end of each period, with the closing balance brought forward. At most, each statement shows the opening balance, the current month's transactions and the closing balance.

Extra work

On the other hand, an open-item statement shows all unpaid invoices and unallocated cash and credit notes going back as far as necessary. Customers generally appreciate this extra detail, but it means more work for the ledger clerk, who has to match each payment against the appropriate invoices. Whichever method you choose at the outset, you are likely to be stuck with it, although a few packages let you specify the method individually for each customer.

A common reason for choosing the open-item method is that it allows balances to be aged. The statement can then analyse the balance according to the month in which the amount was due, which is very handy for those responsible for chasing up debtors. Many systems go one step further and print this analysis in the form of an aged-debtors list — see figure 2. Some even interface with a word-processing program to produce chase letters of increasing severity.

In the purchase ledger the equivalent of the statement is the remittance advice, which is basically a list of the supplier's invoices that the company is paying in the current period. A few packages also provide a forward-payments schedule, which analyses creditors' balances by the months in which they are due and which mirrors the aged-debtors list in the sales ledger. In practice most firms can dispense with this printout because they do their payment runs in strict monthly cycles, with all invoices dated in a given month being paid in the following month.

A more useful feature of the purchase ledger might be its ability to print cheques along with the remittance advices. This is only really attractive for larger firms. If you send fewer than, say, 20 cheques per month, writing them by hand might be faster than loading and unloading the special stationery in the printer. There is also the cost of producing small quantities of the special forms to consider.

The third ledger, the nominal, is the centrepiece of the company's books. The nominal ledger receives postings from the sales and purchase ledgers, and it is from the nominal that the final accounts are ultimately derived. The software should provide two printouts as a minimum: a

(continued on next page)

Control procedures check-list

In computerised accounting, sound control procedures are the key to success. Use this check-list to help evaluate your short-listed packages. If you can answer Yes to every question, the package has a clean bill of health. Any No answer, or a qualified Yes, will need further thought. A high proportion of negative answers is a signal to steer clear of the package.

1. Does the package provide a hard-copy printout of all transactions entered from the keyboard? This is the first and in some ways the most important stage of the audit trail.
2. Are transactions numbered consecutively, either by the user or by the software? Ideally, this number should be printed against the transaction at all stages, forming an essential part of the audit trail.
3. Is there a proper system of batch control? As a minimum, batches should be numbered, and batch totals should be entered and checked against actual totals. Another possibility would be for the system to insist that all batches are self-balancing.
4. Does the system prevent transactions being posted to non-existent accounts?
5. Does the system perform adequate checks as data is entered? For example, does it check that all amounts and dates are present and in the correct format?
6. Are all printouts properly headed? The headings should include the title, data, possibly the time, the period number and a consecutive sequence number. All pages should be numbered and there should be an End of Report message at the end. The aim of this is to satisfy the auditor that no printouts are missing or have been printed and filed twice.
7. Does the system prevent the alteration of transactions, once they have been posted, other than by posting compensating transactions? If it is possible simply to edit the contents of a file, the whole audit trail is useless.
8. Is access to the system restricted where necessary? With a floppy-disc system it might be adequate to ensure that the data discs are locked in a cupboard when not in use. With fixed discs some form of password control or data encryption might be needed.

Figure 1. A sales day book created by a popular spreadsheet program.

Typo Graphics Ltd. SALES DAY SHEET May 1985

Invoice Date	Inv. No.	Customer	Cash Rcvd.	TOTAL	VAT	Net	Design	Type-setting	Art-work	Photo-graphy
		BROUGHT FORWARD		10390.00	1350.00	9040.00	4040.00	2300.40	699.60	2000.00
1/5/85	389	Northern Printing Group		34.50	4.50	30.00		30.00		
6/5/85	390	Practical Publicity Ltd.		402.40	52.40	350.00				350.00
9/5/85	391	Erith Design Consultants		497.95	64.95	433.00	400.00	33.00		
9/5/85	392	Dartford & Meadowcroft Ltd		445.05	58.05	387.00			387.00	
20/5/85	393	Surribridge College		138.69	18.09	120.60	100.00	20.60		
25/5/85	394	Teesdale Advertising Ltd.		345.00	45.00	300.00		150.00	10.00	140.00
		TOTALS THIS MONTH		1863.59	242.99	1620.60	500.00	233.60	397.00	490.00
		CARRIED FORWARD		12253.59	1592.99	10660.60	4540.00	2534.00	1096.60	2490.00

Northwind Ice Cream Ltd.

Number: 5
Period: 5/85
Date Printed: 25th May 1985
Time Printed: 14:30

AGED DEBTORS REPORT

Page 1

Account	Customer	BALANCE	current month	one month	two months	three months	over
010	Associated Wholesale Supply Ltd.	4833.99	432.25	2817.50	1320.40	264.84	0.00
014	Border Confectioners Ltd.	431.25	0.00	431.25	0.00	0.00	0.00
015	Cinema Catering Supplies	4348.75	34.50	672.75	0.00	3641.50	0.00
020	Dorking Centre Restaurant	478.04	11.50	51.75	0.00	299.79	115.00
022	Ennerdale Hotel Group Ltd.	1506.50	1506.50	0.00	0.00	0.00	0.00
023	Firefly Sweets and Crisps Ltd.	1199.76	0.00	431.25	0.00	768.51	0.00
030	Highland Catering Ltd.	994.75	0.00	994.75	0.00	0.00	0.00
033	Northern City Enterpise Co.	7050.40	3560.15	3490.25	0.00	0.00	0.00
040	Petersfield Wholesalers	138.00	0.00	138.00	0.00	0.00	0.00
056	Richmond Centre Hotel	2680.64	0.00	224.25	2456.39	0.00	0.00
058	Rural Scene Cafe	4129.10	1699.85	2052.75	376.50	0.00	0.00
060	Squires Lane Caterers Ltd.	1661.21	389.65	0.00	0.00	1271.56	0.00
064	Timms & Matthews	4209.50	1725.50	2484.00	0.00	0.00	0.00
071	Western College Cafeteria	3126.41	0.00	0.00	3126.41	0.00	0.00
	TOTAL	36788.30	9358.90	13788.50	7279.70	6246.20	115.00

Figure 2. An aged debtors listing; output from an open-item sales ledger package.

(continued from previous page)

full listing of each account, showing all the transactions that have been posted to it, and a trial balance.

Basically, the trial balance is a list of balances of every account in the system, with a grand total. Usually it is arranged so that you can easily distinguish profit and loss account items from those belonging in the balance sheet. So a quick glance at the arithmetic total of the profit and loss balances will give you a rough idea of your overall net profit. In fact, many packages will actually print the final accounts as well, at least in their preliminary forms.

Clearly the cost of full ledger accounting will be higher than with the simpler spreadsheet and cash-book options. As a minimum, you will need a large-capacity floppy-disc machine such as an LSI Octopus, IBM PC or Olivetti M-24, although the hard-disc versions of these systems would be a better bet. Add software, which typically costs £250 to £500 per ledger, and you can expect to spend from £3,000 to £5,000.

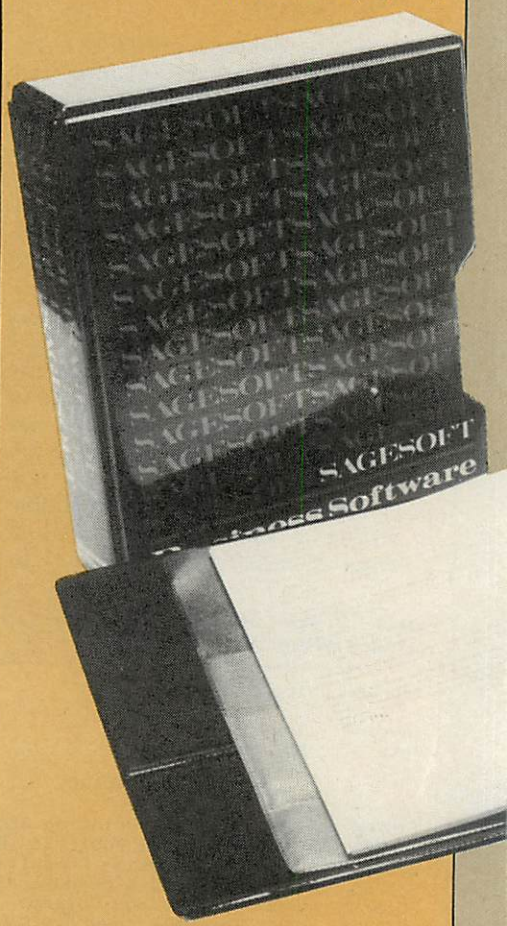
Although the sales, purchases and nominal ledgers are the commonest accounting functions to computerise, you need not stop there. Many firms find it worth adding stock control, order entry, invoicing, job costing and payroll. In a properly integrated system, one transaction will automatically work its way through the network of accounts, updating all the relevant balances along the way.

Such a fully integrated system is the fourth level of computerisation. It has a number of advantages. It can provide even better information than the lower levels, and the balances are always equally up to date. Because it involves fewer keyboard entries, there is less work for the users and a reduced risk of input errors.

But the costs can be high, especially the hardware. The system needs to keep all its software and data on-line at once, so a large backing store is necessary. If it is used by people in different departments, some form of multi-user access or networking will be vital. All this suggests hardware and software costs in excess of £10,000, the final figure depending mainly on the number of terminals required.

(continued on page 114)

```
                    SAGE ACCOUNTS

                                        No. of Entries : -2

 I). INITIALISATION ROUTINE.

     DATA ENTRY ROUTINES
02). Sales Invoices.              11). CREATE LEDGERS.
03). Sales Credit Notes.          12). SALES/PURCHASE LEDGER REPORTS.
04). Sales Receipts.              13). STATEMENT ROUTINES.
                                  14). ACCOUNTS & MANAGEMENT REPORTS.
05). Purchase Invoices.
06). Purchase Credit Notes.
07). Purchase Payments.

08). Cash Book Receipts.          15). INFORMATION TRAIL.
09). Cash Book Payments           16). RECONFIGURATION ROUTINE.
10). Journal Entries.             17). Exit from program.

Which Option :>-
```



Above: Sagesoft's integrated Sage Accounts includes sales, purchases and nominal ledgers. Left: Sage Accounts main menu.

Sage Accounts — how good is it?

How does a typical accounting system measure up to the criteria discussed in this article? To find out, I decided to take a closer look at one such product, the Sage Accounts package from Sagesoft. I chose Sage because it is widely used, with versions available for most business micros.

Sage Accounts offers the three classic ledgers: sales, purchases and nominal. It is an integrated package in that it passes the test of one transaction updating balances throughout the ledgers. But the integration does not extend to linking with other accounting functions such as stock control or invoicing, and there is no way of hooking it up to a word processor for chase letters. A more expensive product, Sage Plus, goes some way to meeting these needs.

The Sage package is very easy to learn, probably because it lacks the bells and whistles of some of the more ammbitious systems. The manual is comparatively free of computer jargon and you are not expected to understand your machine's inner workings to use the product. The only thing I missed in the manual was an index.

For most prospective users, the sales ledger will be the first priority, which is just as well because this is probably the best part of the Sage package. It is an open-item ledger, and the tedious task of matching receipts against invoices is kept as simple as possible. The program has no difficulty coping with part payments, unallocated cash and other quirky situations. Customer statements and an aged-debtors list are available on demand.

On the purchases side, things are a little murkier. Surprisingly, it is not possible to print remittance advices, much less cheques, nor can you simply tell the system that you are paying all invoices for a given supplier. The software seems to expect that you will somehow work out for yourself how much to pay and to whom, then report the fact to the system, identifying each invoice covered. This is perfectly legitimate book-keeping, but it will not save the user very much work.

The nominal ledger does not suffer from any such defect. Wherever possible, postings are made automatically from the other ledgers but you can also enter journals and cash-book items via the keyboard. At any time you can order a full or partial listing of any account, a trial balance, and a set of final accounts for the current period and the year to date. There is also a VAT analysis and a bank reconciliation report.

Given that Sage Accounts is likely to meet the needs of many typical users, how do the control procedures shape up? Measured against our eight-point check-list, the product looks pretty good. There are no problems with the first five points, and the people at Sage have done a good job of explaining batch control in the manual. They even offer sample control forms which fit in with the overall batch philosophy. Point 8 is also covered, with a simple password mechanism.

Two problems remain. First, printouts are not rigorously headed and numbered, although most competing packages are also lacking in this respect. Secondly, it is much too easy to modify postings after they have been accepted. The package comes with a utility program which lets you alter any item in any transaction without validation and completely bypassing the audit trail. So this separate program can be removed from the system disc out of harm's way.

A plus for the system is its handling of budgets. You can allocate a budget amount for any profit and loss item, either as a single yearly figure or as 12 monthly amounts. Either way, the budget report gives neatly presented monthly and year-to-date variance figures. This will prove a little clumsy for firms that have 13 accounting periods per year, although this is the only occasion where the package will cause difficulties for users with non-standard months.

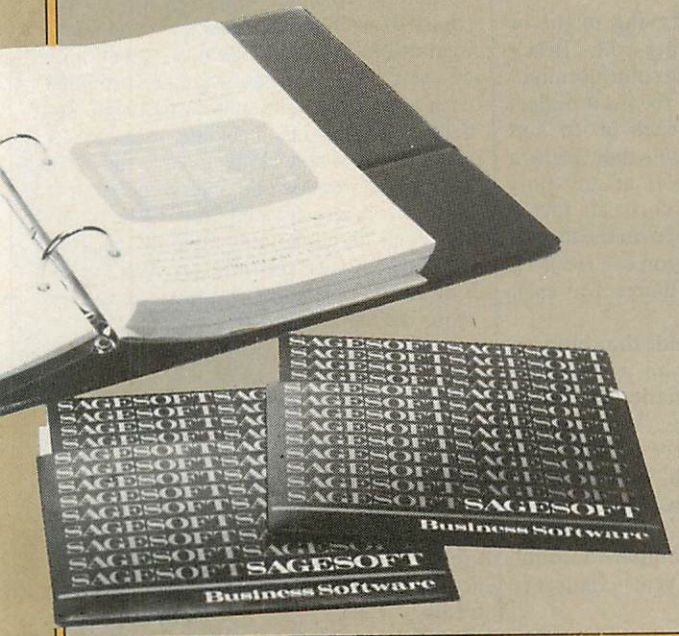
What I liked least about the system is its awkward on-screen editing. Typing data is fine until you make a mistake. You are then faced with one of three different methods of correction, depending on where you are working in the system. You might have to retype an entire entry — no clever Insert and Delete keys here — or specify a sort of grid reference for the erroneous field in order to force the cursor there.

At another part of the system you can use two basic cursor-control keys, Ctrl-E and Ctrl-X, to go up and down respectively. But this is limited to the routine for entering customer names and addresses, which itself has an aura of being tacked on as an afterthought. It is as if the package had been written by different programmers working in separate rooms and never talking to each other.

Of course, none of this detracts from the way the package goes about its main job, that of keeping the books of account. On balance, Sage deserves high marks. With its straightforward approach, its clear documentation, and above all its adherence to proper control procedures, it should find a place on many purchasers' short-lists.

Sage Accounts is available for most CP/M and MS-DOS machines at £375 plus VAT. Although it is advertised as being suitable for floppy-disc based micros, companies whose active customers number into the hundreds might find themselves faced with some clumsy disc swapping, especially when printing statements, so a hard-disc system might be preferable.

For further details contact Sagesoft Ltd at NEI House, Regent Centre, Gosforth, Newcastle upon Tyne. Telephone: 091-248 7077. Sagesoft publishes several other financial packages and we hope to review some of them in a future issue.



(continued from page 112)

Whatever level you go in at there is one vital factor that you must take into account when choosing and planning your system. This is the vital topic of control procedures. Amid the heady prospect of getting your statements out on time and cranking out all those lovely management reports, you might have to stifle a small yawn at the mention of audit trails and batch control. But it is a subject that the newly computerised accounts department ignores at its peril.

Identify entries

There are two basic principles involved. First, there must be a proper audit trail. It must be possible at all times to trace any transaction back to its point of entry into the system and to trace it forward to its ultimate destination. Every entry should be uniquely identified, ideally by means of a consecutive number, and all keyboard input of data should be recorded as hard copy.

The second principle is the concept of batch control. A batch is simply a collection of postings, the integrity of which can be checked. For example, the system might expect you to total the invoices in a batch manually and to enter this figure before entering the invoices. If the actual total does not match the manual figure, the batch is rejected. A good system will also demand the batches themselves to be numbered consecutively, to ensure that an entire batch is not lost.

Most auditors would agree that an accounting system without proper built-in controls is worse than no accounting system at all, so look at the check-list in the box to see how your package measures up. Also try to think of all the mistakes and misfortunes that can happen in your accounts department and work out how the package would cope with them. For example, what would be the result of a payment being posted to the wrong account, or to the same account twice?

The second requirement in choosing a package is to make sure the package does what you want it to. Do not assume that all ledgers are the same, or that any software that produces statements, remittance advices or whatever will be a better option than doing them by hand.

There are scores of details which vary from one accounting system to another. Some are fundamental, like whether sales ledger accounts are open item or balance forward; or whether purchase ledger accounts are debited when the remittance advice is printed or when the user tells the system that the cheque has been sent. There will be an endless hassle if the system does not handle these in the way you require.

Minor hassles

Other details are minor, such as is there enough space for narratives, accounts headers, names and addresses, etc? Is your accounting year split into four-weekly periods or calendar months? It is surprising how many otherwise good packages will reject an attempt to process period 13. Does the software allow periods to overlap so that you can start entering data for a new period before the old one is closed?

There is another danger to watch out for that has nothing to do with accounting. This is the unfortunate habit of some software vendors of copy-protecting their products. Discouraging software piracy is laudable, but the effect is to prevent you from making the vital backup copies of software that are *de rigeur* for any computer user. It means that your entire accounting operation, and consequently the very survival of the company, could be dependent on the fragility of a single floppy disc.

Most vendors will not volunteer the information that the product is copy-protected; you have to ask. Happily, there are many good accounting packages on the market that are copyable — but not, of course, for resale. So if a dealer does try to sell you a copy-protected product, run, don't walk, out of the shop.

Tracking progress

Another thing worth having might be some help with tracking the firm's progress against budget. In some nominal-ledger packages, you can record a budget or target figure against each profit and loss item. The software will then print a budget versus actual report at any time during the year, applying a pro rata factor to the budget amounts based on the month number. In other systems you can record a separate set of budget figures for each month of the year.

Other handy extras include the ability to make repetitive postings on a standing-order basis and the automatic reversal of certain kinds of postings. The latter is useful for producing a set of mid-year accounts, complete with depreciation, closing stocks, etc., these adjustments being later removed for normal day-to-day work. The ability to compare account balances against the prior year's figures is another popular feature.

By now you should have a pretty clear idea of what you want your accounts package to do. So how do you go about finding one? First write a list of your requirements, identifying those that you must have and those that it would be nice to have. As with any difficult purchase it is better to define your requirements first and then to see how the prospective packages match up, rather than the other way round.

Also estimate the volumes of data that the system is to process. You will need to have a clear idea of the number of customers, suppliers, invoices, statements, cheques, etc., both as averages and as maxima in peak months. Allow plenty of scope for expansion. Put these figures to your potential suppliers, and get them to confirm — preferably as a condition of your order — that their system will be able to cope.

Before you start going to demonstrations of packages, sit down and have a long talk with the people who matter most in this whole operation: your auditors. At the very least, go over your list of requirements with them and get their OK. After all, if they are not happy with what the system will do, nobody will be. Check with the auditors again when you have made a short list.

No guinea pig

Most people who have installed a computer system will tell you to select the software first then pick the hardware that it will run on. This is sound advice, but you should nevertheless keep half an eye on the actual computer. Do not be tempted to buy a package that only runs on an obscure, little-known machine. Also, try to avoid the latest technology — let somebody else be the guinea pig. If you stick to a computer that runs one of the mainstream operating systems like CP/M or MS-DOS you will be on fairly safe ground.

Finally, consider carefully the related topics of training, maintenance and documentation. If a vendor makes a great thing of the training courses that are provided with a package, take it as a bad sign. No decent accounting package requires its users to learn new skills, even if the users have never worked on a micro before. It is better to choose a system that is easy to use and well documented, if only because training courses are only valuable for as long as the particular employee continues to do the same job.

Maintenance is another story again. You never know when legislation or new accounting practices will necessitate changes to the system, so be sure you are buying from a substantial company that is likely to be around when such changes are needed. When Statutory Sick Pay was introduced in 1983, a good many payroll users found that their software could not cope and their suppliers had ceased trading. PC

For Charles, Arnold and Frederick, the business battle just ended.

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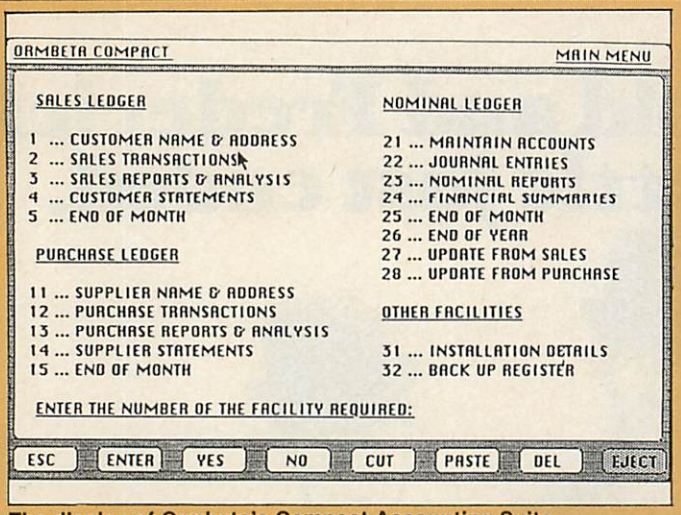
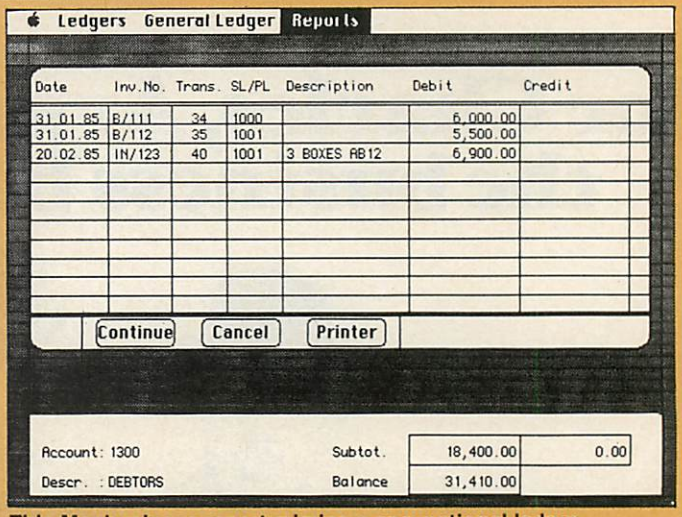


The display of Ormbeta's Compact Accounting Suite.



This Macbusiness report mimics a conventional ledger.

Wimps in the accounts department

Chris Bidmead looks at how the coming generation of window, icon and mouse programs are set to change the face of accounting software.

UNTIL THE ARRIVAL of the IBM PC, business microcomputers were happy to write out their data to VDUs and printers that used character output only. They produced only letters of the alphabet, numbers, punctuation marks and a limited selection of formatting codes like screen positioning, tabbing and returning the print carriage to the first column.

It was a simplified view of the world, but it required only 128 different codes to cover the whole repertoire, a figure that represents the number of ways you can combine seven bits. The eighth bit was originally reserved for error checking, until greater reliability in transmissions systems freed it for subsequent use in defining exotic extensions of the 128-character set.

The screen of the basic IBM PC is an extended character-orientated display of this type. But the hardware design has left it open to users to add additional circuitry that makes the minimum unit of display the pixel rather than the character. Colour too can be added in the same way, and IBM PCs and IBM clones with enhanced graphics are rapidly becoming the norm for business computing. This development is matched by the introduction of high-resolution dot-matrix printers that can control the deposit of ink on paper to a fraction of a millimetre.

The ability to work at pixel level can make life easier for us in three main ways. Most obviously, there is the option of turning blocks of numbers into charts. For the accountant this is a valuable way of, literally, getting the overall picture. Secondly, conventional data entry and retrieval can be made easier, and therefore less prone to error, with aesthetically pleasing forms layout and the use of windowing. Thirdly, graphics can open up the micro to new techniques of information management where the analysis is essentially pictorial.

Of the numerous micros available, the Apple Macintosh with its friendly user interface looks like the most promising vehicle for de-stodged accounting software. But as yet the U.K. software market

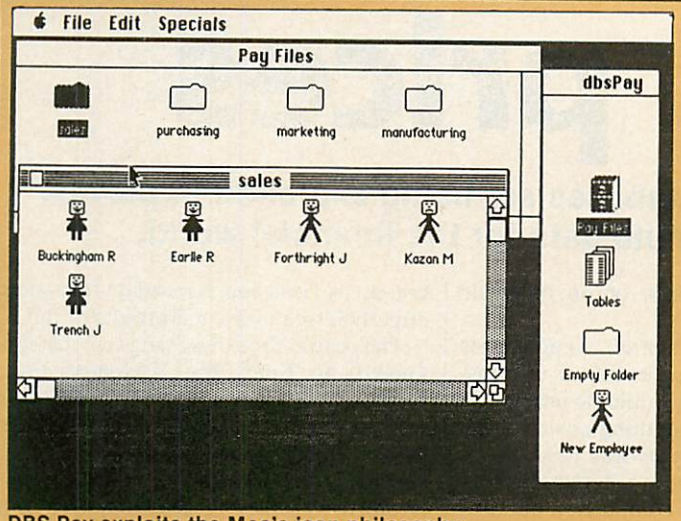
has a very restricted choice for the accountant with a Macintosh. What software there is hardly exploits the Mac's unique visual interface, perhaps because software writers are wary of making their products look like games or, more likely, because of the widely reported difficulty of developing software in the Mac environment.

This is a pity. The 128K Macintosh is not a particularly speedy machine, and the newer 512K version even with an added external drive still appears slow against the IBM PC and its clones. But what it promises is a clarity, simplicity and consistency of interface that may in practice be more valuable than speed.

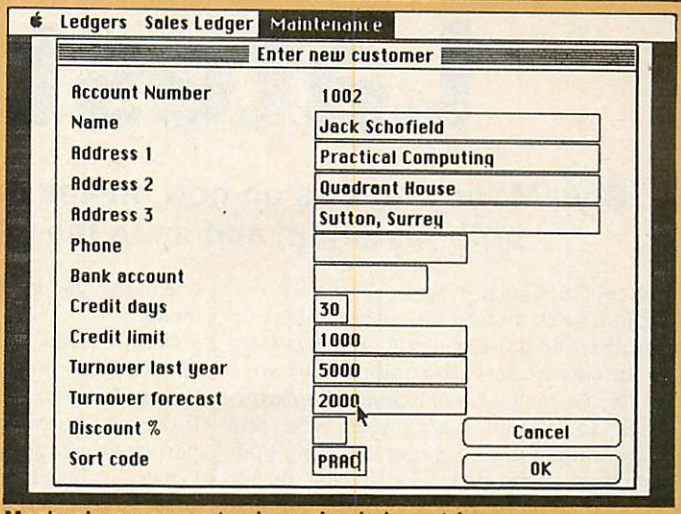
The Compact Accounting Suite from Ormbeta is a program which suffers most in the comparison. It is simply a straight translation of the same Pascal-based accounting suite that runs on the IBM PC. The current version of the Ormbeta package makes no use of icons or even pull-down menus, and until the software is expanded to include them it must be regarded as a stop-gap product at best.

Doubt hovers over the future of two software suites from Peachtree, announced last year. The company is on the point of being devolved from its multinational parent, MSA, and Peachtree's MacCash and Macledger are currently in the process of being sold off to as yet undisclosed buyers. The skeleton team at Peachtree's Maidenhead office has its work cut out supporting existing users, and will not be welcoming new sales enquiries until the dust has started to settle.

The only two Macintosh accounting



DBS Pay exploits the Mac's icon philosophy.



Macbusiness presents clear, simple layout forms.

software we were able to obtain for review was DBS Pay, a payroll system from Deverill Business Systems, and the Macbusiness Software Suite from Systematics. Both are conversions from packages extensively tried and tested on other machines, giving the user the important assurance that they do their jobs sensibly.

But neither software suite grasps the opportunities the Mac offers, and both depart from conventions of use established by mainstream Mac software. This means that in running a variety of packages, the user will still have the old problem of the IBM environment: remembering what commands result in which actions in whose software.

DBS Pay illustrates this kind of lapse by, for example, offering a box for entry of the company name when setting up the system that indicates space for 43 characters but only accepts 26. A consistent Mac convention is, sensibly enough, to size entry boxes to indicate the maximum length of entry. This is a trivial but nonetheless tiresome example of how visual clues can make life more difficult for the user unless they are thoughtfully implemented.

Not standard

There are other subtle but confusing departures from the Mac standard interface. The system allows you to group employees together in folders, the Mac equivalent of a sub-directory, but when I tried naming two such folders Employee Details and Current Employees the titles were rejected by DBS with a message that folders with these names already existed. They didn't, at least not visibly, and if the system was using hidden folders it seems silly that they should have internal names that a user is likely to need.

Any payroll system is full of sensitive information, and quite properly the entry to DBS is password protected. Naturally the system also has a means of disposing of unwanted files. The Mac convention is to have an icon called Trash on the desk top into which files for disposal are dragged. Harmlessly, but a little unnecessarily, Deverill rename it Wastebasket. As a safety feature, the Trash/Wastebasket can be reopened to retrieve files at any time up to the moment the Empty Wastebasket routine is activated from the menu bar.

System vulnerable

It doesn't take a moment's thought to realise that the best place for a file-disposal facility is on the far side of the password protection. Allowing valuable files to be trashed without having to enter the password, Deverill has left the system rather vulnerable to the careless employee who, having inserted the wrong disc by mistake, is tempted to experiment by pushing the icons around. A couple of false moves with the mouse, and bang goes your customer list.

A hint that this is a bug rather than deliberate design is the way ghosts of these deleted folders return when you fill in the password and enter DBS Pay proper. Their outlines reappear in the Pay Files filing cabinet, and look like authentic folders, but on trying to open them you are greeted with the message

I am unable to find the <folder name> folder . . .

It goes without saying that sensible users will always have backups of data files, but only the most ponderous arrangement can guarantee they will always be 100 percent up to date.

Another curiosity is the way you can trigger the Open function in the pull-down File menu even if you haven't selected anything to open. This produces the error message

Please select something before choosing the command

The standard Mac way of handling this is to keep the Open option non-active unless an object has been selected, and I cannot see that Deverill has any excuse for departing from this rule.

The method of transferring employee icons between folders is different from and more cumbersome than the established Macintosh technique of simply dragging the icon from one folder to another. DBS Pay does not allow more than one folder to be open at a time, so you have to go through a lengthy process of selecting an employee in one folder, activating a transfer function from the menu line, closing the folder, opening the next folder and returning to the menu line to pull down the Save Employee function. Worse, you can only transfer one employee at a time, so departmental reorganisation is hardly going to be easy.

While Deverill's handling of the Mac system is obviously still in an early stage, the program itself is very comprehensive, covering all the usual aspects of payroll, including Statutory Sick Pay, National Insurance and coin analysis. The system will not print cheques, but is capable of producing Giro credit forms on special stationery.

Plenty of help

You won't come across anything like this in the Macbusiness suite from Systematics, a general-purpose double-entry accounting package that requires at least an external disc drive. It offers almost enough on-line help to make the well-written manual redundant, but apart from using the screen to present clean and legible entry forms, it makes virtually no use of the Mac's graphics capabilities.

Access to the various ledgers and functions is by way of pull down menus, not by icon manipulation. Useful Mac facilities like the notebook and the scrapbook are no longer available once Macbusiness is booted up, and in a system that requires VAT to be manually calculated upon entry of invoices I particularly missed the desk-top calculator.

Systematics calls Macbusiness "a quantum leap forward", but the claim seems extravagant to say the least. Remember the old-fashioned accounting software that wouldn't allow you to retreat from trivial mistakes like writing to a printer you forgot to plug in? Systematics carries on the tradition by, at one juncture, insisting that you insert a particular disc and accepting no escape. PC

Latest prices

Glyn Moody reports on how on-line databases are being exploited to provide both historical and up-to-the-minute data for the financial world.

ON-LINE financial programs fall into two main classes: those that push numbers up the line, and those that pull in figures from it. Interactive services combine the two.

The first class is something of a throwback to bureau days, when you sent away mountains of paper detailing your accounts to be processed by an outside firm, and received wads of the familiar green-lined computer printout a few days later. The on-line element obviates the need to use paper for the input data — a not so trivial saving when it amounts to 700 million pieces of paper, as it does for the Banks' Automated Clearing Services, BACS.

Some eight million salaries and 39 percent of all occupational pensions are paid through BACS, which allows payments to be made to bank accounts without the need for pieces of paper to be sent to the appropriate bank. Instead, instructions are sent either over the telephone via modems, or on magnetic media.

With BACS a central computer is employed to co-ordinate millions of transactions in a way that would be impossible if the distributed computing power of the participating companies was used alone. Generally there has been a shift away from such large external computers, but one area where mainframes are coming into their own is the on-line database.

This second type of on-line activity consists of pulling out financial information from one of the many huge databases now available. A distinction can be drawn between databases providing predominantly real-time services, which are sometimes updated on an hourly basis, and those offering static historical data, whether numerical or textual.

Up-to-date financial information is vital for many businesses, and on-line provision is clearly one of the most efficient ways of obtaining it. The basic areas covered by real-time financial services are stock and money markets, commodities and foreign-exchange rates. The fount of share information in the U.K. is the Stock Exchange.

Only a starting point

Neither the settlement system currently used within the Stock Exchange, Talisman, the one under development, nor Stock Exchange Automated Quotations, is designed for the outside user as an on-line service. But both form the starting point for the Stock Exchange's own share-information services, and for many other on-line hosts which receive data feeds from the Stock Exchange.

A private viewdata service, Topic, is the main channel of dissemination. With over 3,000 terminals in use, split evenly between Stock Exchange members and outside institutions, it was set up in 1980 and currently has over 22,000 pages. It offers real-time information on share prices, together with company results and any other announcements required by the Stock Exchange from listed companies. There are also a number of services which are taken from outside bodies, such as the London International Financial Future Exchange, and foreign-currency exchange rates.

Member firms can also set up closed user groups within Topic, which typically provide daily comment on the market to clients. Most users have dedicated terminals, but emulation software is available for the IBM PC. Topic can also be bought as Topicline, a viewdata feed taken directly into a user's mainframe or mini.

The central Stock Exchange computer is known as Epic, the Exchange Price Information Computer. The CRS data feed services are taken from Epic. Unlike Topic, which is already cast in the form of viewdata, this is the raw numerical data. It is taken by other on-line suppliers as a source for their own services.

World stock exchanges

Perhaps the largest of these suppliers is Reuters. Currently some 40,000 stocks from 82 stock exchanges throughout the world are quoted, and it expects to add another 20,000 this year. Reuters offers a wide range of real-time data: in addition to securities, there are exchange rates, commodities, energy prices and money market figures.

Reuters has just under 20,000 contracts with 47,000 terminals. At present only dedicated terminals are available. Rather than opting for terminal emulation on personal computers, Reuters is offering terminals with the ability to mimic personal computers as well as the possibility of accessing other on-line databases.

A recent development is the use of BBC Micros as high-resolution graphics terminals to provide visual analyses of data pulled in from Reuters databases. This kind of interactive use of financial information, where data is actively manipulated on a micro, rather than just passively viewed on a terminal, is one of the main areas of growth in on-line services.

Extel has moved some way along this road. Its Priceline is a dial-up service that can be accessed from computers or via a local area network. It lists some 4,000 U.K. security prices. Microlink allows you to download files to micros, where they can be fed into other packages such as spreadsheets or word processors. The top-of-the-range system Exshare gives details on some 75,000 companies, but to use it you need mainframe or mini power together with programming expertise to deal with the raw data form in which it is sent.

The U.S. market is dominated by two companies, Quotron and Telerate, which offer largely complementary services. Quotron was set up in 1957 and now has 72,000 terminals in the U.S. Its overseas operations are handled by a joint venture between Quotron, Allied Press and Dow Jones. Information on about 6,000 U.S. companies is held, together with 35,000

BACS

The Banks' Automated Clearing Services is run as a non profit-making body on behalf of the five shareholding banks: Barclays, Lloyds, Midland, National Westminster and Wiliams and Glyn's. BACS was started in 1972, and grew out of studies made during the late 1960s on ways of automating the process of fund transfer. At first it was a scheme operated by the main clearing banks purely for themselves but later major insurance companies asked to join and the system evolved into the present large-scale operation. Currently 23 percent of all clearing takes place through BACS. It is hoped that by 1989 this will have grown to 40 percent.

Initially 0.5in. magnetic tape was the standard medium for transferring funds. Cassettes were introduced, which for small users were replaced by 8in. floppies and then 5.25in., both using IBM formats. The alternative on-line service is assuming increasing importance and over 5 percent of all BACS transactions now use this method. More than 60 devices, including some word processors, can now access this dial-up version of BACS.

To use BACS you must be sponsored by a bank. Charges for the service are then made to the bank, which passes them on to the end-user. Further information on BACS can be obtained on 01-952 2333 or from any bank.

overseas firms. The AP/Dow Jones news services is also carried. There is a dial-up version of the service, which allows an IBM PC to be used as the terminal, as in the Extel system. The other U.S. company, Telerate, concentrates on money and foreign-exchange markets. Both services include subsets of each other's systems as part of the packages they sell.

60Gbyte of information

IP Sharp Associates is based in Canada and has a wide range of data updated daily as well as large historic databases, mostly numeric. Altogether, over 60Gbyte of information is available on-line. IBM PCs can be used as intelligent terminals, and developments are underway that will allow selected data, such as share prices in a portfolio, to be pulled in and manipulated off-line. The service provided by Datastream already encompasses this. As well as offering standard stocks and shares information on-line, it has a fully interactive portfolio evaluation system. There are about 800 to 1,000 direct subscribers, who use Datastream for research, evaluation and associated accounting functions.

In addition to using dedicated lines and terminals, you can dial up Datastream over the telephone, and then use a micro with a modem. It is not possible to pipe data provided by the basic service through to other programs directly. To remedy this situation, the Data Channel has been introduced recently. It enables you to pull out financial information and use it in software such as Lotus 1-2-3, databases and word-processing packages.

A further package called DS-Comm allows a micro like the IBM PC or Apple to function as a dedicated terminal as well as a stand-alone micro. Datastream is currently evaluating further hardware add-ons to provide users with other analytical tools such as high-resolution graphics for use with its databases.

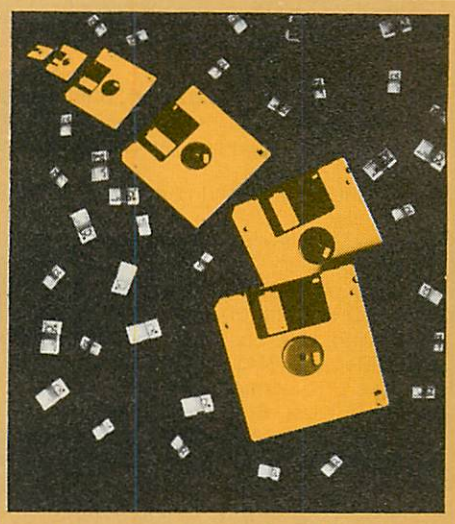
Most of the on-line services described so far have used either dedicated terminals, or special emulation programs for a limited range of micros. To access Citiservice, which forms part of the Prestel viewdata service, the only extra hardware you need is a modem and Prestel adaptor. It is run by ICV Information Systems and is jointly marketed with British Telecom.

Citiservice has been around for about two years, and has over 14,000 pages of information. It is currently one of the fastest-growing areas on Prestel. The total number of accesses in the month of January 1983 was 244,000; for the same time this year, the figure was 1.9 million. Citiservice draws on a number of outside bodies such as the Stock Exchange, Midland Bank and LIFFE for the financial information it displays. But it is beginning to move away from just supplying regularly updated figures.

One of its innovative services is telebroking, run in conjunction with the stockbrokers Hoare Govett. It is now possible to buy and sell shares on an on-line basis. Other services under development include share-portfolio evaluation and a tax manager for carrying out personal tax calculations.

A number of real-time on-line services are moving towards a far more interactive approach. Figures from the databases are available for analysis, as a result of which action can be instigated via the same on-line connection. This kind of two-way flow over telephone lines has its parallels in the interactive banking service offered by the Bank of Scotland on Prestel.

But another very large class of on-line financial service is rather different. Where the Stock Exchange and Reuters are predominantly concerned with providing the latest information, allowing minute-by-minute responses to the situation, the historical database is more concerned with



providing huge quantities of old data. Typically these would form part of one of the extensive time-series, which present various economic indicators like GNP, population, exports, steel production and so on for particular countries, year after year. This is useful for large-scale financial modelling, corporate planning and business forecasting. One of the largest time series in Europe is Cronos, which holds information in 26 main areas, going back to the first relevant data in the European Communities' history, which may be as early as the 1940s.

These historical databases are mainly numeric. But there are also extensive collections of texts relating to financial and economic matters. Abstracts of relevant journals are a case in point, and another large class is that of information on companies. One of the benefits of working on-line, rather than from books or journals, is that comprehensive searches can be carried out through huge databases in a matter of seconds. In fact many of the possible search patterns would not be feasible under any other system.

If important financial transactions are being carried out on-line there are clearly opportunities for industrial espionage, which could take the form of introducing significant errors in data feeds, or simply gaining advance notice of crucial commercial transactions. On-line financial services doubtless offer tremendous advantages to the business community, but they also pose considerable threats.

(Table of databases and hosts on next page)

Real-time financial services

Further information on the services mentioned can be obtained from the following:

Citiservice: (04862) 27431
Datastream: 01-250 3000
IP Sharp Associates: 01-222 7033
Quotron and Telerate: 01-353 6723
Reuters: 01-250 1122
The Stock Exchange: 01-588 2355

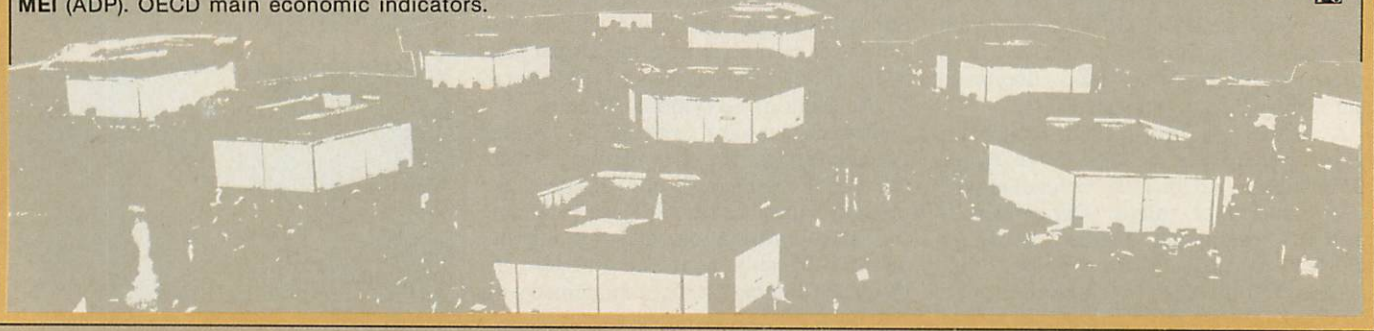
On-line financial databases

ABI/Inform (ESA-IRS, Datastar). Business management and administration.
AECO (G.CAM). Agence France Presse — economic news items.
Axess (Sligos). French industry — companies, managers, products.
Bancall (ADP). Financial statistics on 14,000 U.S. commercial banks.
Bancompare (ADP). Annual data on U.S. banks.
Bank (ADP). Bank of England financial statistics.
BCD (ADP). U.S. business conditions digest.
BOE-Databank (SIA). 4,000 monthly and quarterly time series on the U.K. economy.
Bourse (Sligos). Prices and dividends of 300 listed companies on French stock market.
Business (Datastar, Inka). Worldwide trade opportunities and business contacts.
Cititbase (SIA). U.S. principal indicators.
CN1 (GSI-ECO). National accounts, main aggregates.
CN2 (GSI-ECO). National accounts, detailed aggregates.
Comext (CISI). External trade statistics produced by Eurostat.
Compubond (ADP). Daily prices and yields for fixed-income securities.
Compustat (ADP). Balance-sheet statistics of 6,000 U.S. companies.
Conference Board (ADP). 750 business-related economic time series.
Cronos (CISI, Datacentralen). Sectoral information.
Cronos Eurostat(CISI, Datacentralen). Statistical data bank.
CSO (ADP). U.K. macroeconomic statistics from CSO.
Defotel (Questel). Financial information on 1,500 French and foreign companies.
ECAB (Belindis). Economic abstracts international.
ESSOR (Questel). Management, personnel and field of activity of 65,000 French companies.
Europrospects (ADP). Daily updated economic and financial statistics on EC countries.
Exstat (ADP). Balance-sheet statistics of 2,500 companies.
Fastock (ADP). Daily updated U.S. securities prices and volumes.
Fintel/FT (Datastar, SIA). Company and business information abstracts from the *Financial Times*.
FISC (G.CAM). Finance legislation in France.
FUTU (Datacentralen). Journal articles in all subject areas of forecasts, trends and ideas of the future.
Future (ADP). Daily world commodities prices.
FX (ADP). Daily exchange and interest rates at New York.
GSI Data (GSI-ECO). French and international economic data.
Harfax (Datastar). Marketing and finance.
Hoppenstedt database (Datastar). Data on German companies and their products.
IAI (GSI-ECO) OECD industrial activity indicators.
ICF (CISI). Economic cycle for France.
IFS/FMI (ADP, CISI). Financial data for member countries of the IMF.
IMF/IFS (SIA). Financial data for member countries of the IMF.
Indicators (CMS). Main economic indicators from OECD.
International Economic Abstracts (Datastar). Economic information on markets, trends, investments worldwide.
Isis (G.CAM). Information on economic climate, company law.
Key British Enterprises (Pergammon Infoline). Profiles on top 20,000 companies in Britain.
Lex (Questel). French official journal.
Management Contents (Datastar). Business information.
MEI (ADP). OECD main economic indicators.
MMA (Pergamon Infoline). Management and marketing practices worldwide.
Monitor (ADP). Daily updated foreign-exchange and interest rates.
PERA (ADP). Historical and forecast statistics for developed countries.
PERB (ADP). Historical and forecast statistics for developing countries.
PINNCA (SIA). Price index numbers for current-cost accounting.
Predicasts Annual Reports (Datastar). Textual abstracts and statistical tables from annual reports.
Predicasts Forecasts (Datastar). Published numeric forecasts on products, industries, demographics and national incomes.
Predicasts Prompt (Datastar). Business and technology. products and industries worldwide.
Pricedata (ESA-IRS). Financial information about commodities, currencies and markets.
Selecval (Sligos). Financial data on 1,000 French and European listed companies.
SGB-DOC (Datastar). Economic, financial, monetary, social and industrial matters.
Share Price Data (Scicon). Daily prices for U.K. market on equities, commodities and overseas stocks.
Statis-Bund (CISI). 60,000 time series from the German Federal Office of Statistics.
STP (ADP). Short-term forecasts of main U.S. indicators.
Telexport (G.CAM). Aids for external trade.
Textline (ESA-IRS, Finsbury). Business information.
UKSCO (SIA, Scicon). Macroeconomic indicators for the U.K.
UK Treasury (SIA). Major U.K. time series.
USEcon (ADP). Daily U.S. financial and econometric statistics.
VLTP (ADP). Long-term forecasts of main U.S. indicators.

Database hosts

ADP: Poortweg 4, 2612 Delft, The Netherlands. Telephone: (010 31 15) 569382.
Belindis: 30 Rue J A de Mot, 1040 Bruxelles, Belgium. Telephone: (010 32 2) 233 6737.
CISI-Wharton: Ebury Gate, 23 Lower Belgrave Street, London SW1W 0NW. Telephone: 01-730 8171.
CMS: Mainzer Landstrasse 27, 6000 Frankfurt am Main, West Germany. Telephone: (010 49 611) 231561.
Datacentralen: Retortvej 6-8, 2500 Valby, Denmark. Telephone: (010 45 1) 468122.
Datastar: Plaza Suite, 114 Jermyn Street, London SW1Y 6HJ. Telephone: 01-930 5503.
Finsbury Data Services: 68-74 Carter Lane, London EC4V 5EA. Telephone: 01-248 9828
G.CAM: Tour Maine-Montparnasse, 33, Av. du Maine, 75755 Paris, France. Telephone: (010 33 1) 538 1070.
GSI-ECO: 25, Boulevard de l'Amiral Bruix, 75782 Paris, France. Telephone: (010 33 1) 502 1220.
Inka: 7514 Eggenstein-Leopoldshafen 2, West Germany. Telephone: (010 49 7247) 824566.
IRS-Dialtech: Room 392, Ashdown House, 123 Victoria Street, London SW1E 6RB. Telephone: 01-212 5638.
Pergamon Infoline: 12 Vandy Street, London EC2A 2DE. Telephone: 01-377 4650.
Questel: 83-85 Boulevard Vincent Auriol, 75013 Paris, France. Telephone: (010 33 1) 582 6464.
Scicon: Brick Close, Kiln Farm, Milton Keynes MK11 3EJ. Telephone: (0908) 565656 ex 343.
Sligos: 91 Rue Jean Jaures, Puteaux, France 92807. Telephone (010 33 1) 776 4242.

PC



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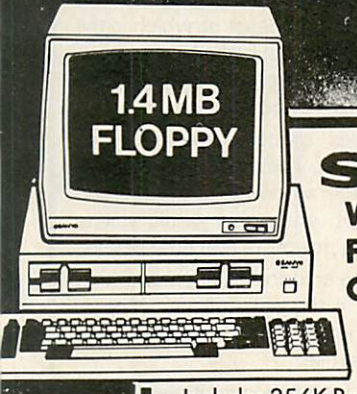

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CONTENTS

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We welcome serious software for any of the micro systems listed opposite, especially short routines and utilities. Programs can be in machine code, Basic or any other language.

Submissions should include a brief description which explains what your program does, and how it does it. If possible it should be typed, with lines double-spaced. We need a printed program, which should be listed from a fully debugged, working program. Hand-written listings cannot be accepted. A tape or disc of the program helps if it is in a standard format.

When printing listings, please remember to use a new ribbon or double-intensity printing — faint listings reproduce badly. Use plain paper only, and try to list the program across either a 35-character or a 70-character width. Also, make sure all special graphics, inverse video characters or any other non-standard symbols are either listed correctly or else include Rem statements to explain them fully.

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Tandy	John Wellsman
Research Machines	Ian Stobie
Sharp	John Hooper
Sinclair QL	Glyn Moody

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INSIDE OS

Roger Cullis concludes his examination of the BBC Micro's operating system with a look at the way it uses space in low-memory RAM.

WHEN THE COMPUTER is switched on, the OS sets up a number of pointers or vectors at the bottom of page 2, in the area &0200-0235. These vectors are two-byte addresses of the entry point of routines which perform specific operations. For instance, the user printer routine pointer, UPTV, is at &0222-0223. Thus, when the computer wishes to send a byte to a printer via a user-installed output routine, it sends it to the address stored at these two locations. In conventional 6502 practice, the low byte is stored in the lower and the high byte in the higher address location.

Since the pointer locations are in read/write memory, they may easily be changed. If a new filing system is initialised, it will change the values of certain of these vectors to point to its own routines. Alternative versions of the OS require their own vector settings, since the layout of the ROM is different in each case.

An OS variables store and workspace is located at &0236-02FF. Parameters used by the operating system are stored in page 2 above the OS vectors. They are updated by the OS housekeeping routines and may be read or reset by user- or program-initiated calls.

The bottom half of page 3 is devoted to storage of parameterss needed for the screen display. The main part of the top of page 3, &0380-03DF is similarly allocated to the cassette and ROM filing systems. Addresses &03E0-03FF hold the keyboard input buffer.

If no second processor is connected pages 4 to 7 are allocated to the current language ROM. For example, they are used by Basic for its variable tables and loop, function and subroutine parameter stores. If, however, a second processor is connected and active, the DNFS ROM installs the routines required for Tube communications in pages 4 to 6. In a protocol similar to that used by the sideways ROMs, there is a language entry point at &0400 and a service entry point at &0403. The data-transfer routines start at &0406.

In order to permit synchronisation of sound commands to different channels, the commands are transferred from the four sound buffers to queues in page 8, in the area &0800-083F. The four queues are indexed by buffer number. They are serviced during the maskable interrupt processing routine. At the appropriate time, parameters are taken from the sound queues, processed and passed as instructions to the sound-generator chip. The remainder of pages 8 to C are allocated to input and output buffers.

NMI routines are held in &0D00-0D9E. High-priority filing systems such as the disc and Econet use non-maskable interrupts. When these systems are initialised, they install NMI routines at the bottom of page D, changing them according to prevailing circumstances. The CFS and RFS do not use NMIs, so on Reset the OS installs an RTI op code, &40, at address &0D00.

The area &0D9F-0DFF holds a paged ROM variables store. To permit the OS vectors to point into a paged ROM, an extended vectors table is maintained at &0D9F-0DEF. This contains the value of each vector — low then high — followed by the corresponding ROM number. Paged ROMs require space for storage, such as filing-system I/O buffers. This space may be shared with the other paged ROMs as public workspace, or it may be reserved exclusively for an individual ROM as private workspace. Both are allocated on Reset, a table of private workspace addresses being maintained at &0DF0-0DFF.

COPYRIGHT

This article summarises the operation of the BBC Micro and where the routines are to be found, and is intended to help users to write programs which interact fully with the built-in software. But you should remember that the source code and object code of ROM routines are the subject of copyright and may not be used without the copyright owner's permission. Although you may freely call them from programs running on the computer, you cannot extract or copy them for your own software.

MOS VECTORS

```
0200      :(E310) USERV - user vector
0202      :(DC54) BRKV  - break vector
0204      :(DC93) IRQ1V - high priority interrupt vector
0206      :(DE89) IRQ2V - low priority interrupt vector
0208      :(DF89) CLIV  - command line interpreter vector
020A      :(E772) BYTEV - OSBYTE indirection vector
020C      :(E7EB) WORDV - OSWORD indirection vector
020E      :(E0A4) WRCHV - write character vector
0210      :(DEC5) RDCHV - read character vector
0212      :(F27D) FILEV - file processing vector
0214      :(F18E) ARGSV - file arguments vector
0216      :(F4C9) BGETV - get byte vector
0218      :(F529) BPUTV - put byte vector
021A      :(FFA6) GBPBV - get block/put block vector
021C      :(F3CA) FINDV - open/close file vector
021E      :(F1B1) FSCV  - filing system control vector
0220      :(FFA6) EVNTV - event handling routine vector
0222      :(F3CA) UPTV  - user PRINT routine vector
0224      :(FF36) NETV  - ECONET vector
0226      :(FFA6) VDUV  - VDU processing vector
0228      :(EF02) KEYV  - keyboard access vector
022A      :(E4B3) INSBV - buffer insert character vector
022C      :(E464) REMV  - buffer remove character vector
022E      :(E1D1) CNPV  - count/purge buffer vector
0230      :(FFA6) IND1V - unallocated vector
0232      :(FFA6) IND2V - unallocated vector
0234      :(FFA6) IND3V - unallocated vector
```

MOS VARIABLES STORE AND WORKSPACE

```
0236      :(90) -OSBYTE A6- MOS variables base address lo
0237      :(01) -OSBYTE A7- MOS variables base address hi
0238      :(9F) -OSBYTE A8- ROM pointer table address lo
0239      :(0D) -OSBYTE A9- ROM pointer table address hi
023A      :(A1) -OSBYTE AA- ROM information table address lo
023B      :(02) -OSBYTE AB- ROM information table address hi
023C      :(2B) -OSBYTE AC- key translation table address lo
023D      :(F0) -OSBYTE AD- key translation table address hi
023E      :(00) -OSBYTE AE- VDU variables start address lo
023F      :(03) -OSBYTE AF- VDU variables start address hi
0240      :(00) -OSBYTE B0- CFS timeout counter (vertical sync counter -
          :                 decremented 50 times/sec)
0241      :(00) -OSBYTE B1- current input buffer number
0242      :(FF) -OSBYTE B2- keyboard interrupt processing flag
0243      :(00) -OSBYTE B3- primary OSHWM
0244      :(00) -OSBYTE B4- OSHWM address hi
0245      :(01) -OSBYTE B5- RS432 mode
0246      :(00) -OSBYTE B6- character definition explosion switch
0247      :(00) -OSBYTE B7- filing system flag - 0=CFS, 2=ROM
0248      :(00) -OSBYTE B8- current video ULA control register setting
0249      :(00) -OSBYTE B9- current palette setting
024A      :(00) -OSBYTE BA- number of ROM enabled before last BRK
024B      :(FF) -OSBYTE BB- number of BASIC ROM
024C      :(04) -OSBYTE BC- current ADC channel number
024D      :(04) -OSBYTE BD- maximum ADC channel number
024E      :(00) -OSBYTE BE- ADC conversion type (00 - default, 08 - 8-bit,
          :                 0C - 12-bit)
024F      :(FF) -OSBYTE BF- RS432 busy flag (bit 7 reset = busy)
0250      :(56) -OSBYTE C0- current ACIA control register setting
0251      :(19) -OSBYTE C1- flash counter
0252      :(19) -OSBYTE C2- mark period count
0253      :(19) -OSBYTE C3- space period count
0254      :(32) -OSBYTE C4- keyboard autorepeat delay
0255      :(08) -OSBYTE C5- keyboard autorepeat rate
0256      :(00) -OSBYTE C6- *EXEC file handle (0 - not allocated)
0257      :(00) -OSBYTE C7- *SPOOL file handle (0 - not allocated)
0258      :(00) -OSBYTE C8- bit 0 - ESCAPE enable/disable
          :                 bit 1 - BRK normal/memory clear
0259      :(00) -OSBYTE C9- Econet keyboard disable flag
025A      :(20) -OSBYTE CA- keyboard status - bit 3 - 1=shift pressed,
          :                 bit 4 - 0=caps lock, bit 5 - 0=shift lock,
          :                 bit 6 - 1=control, bit 7 - 1=shift enabled
025B      :(09) -OSBYTE CB- buffer space left at buffer full signal
025C      :(00) -OSBYTE CC- RS432 input suppression flag
025D      :(00) -OSBYTE CD- cassette/RS432 selection flag (CFS-0, RS432-40)
```

```
025E      :(00) -OSBYTE CE- Econet OS call interception flag (bit 7)
025F      :(00) -OSBYTE CF- Econet OSRDCH interception flag (bit 7)
0260      :(00) -OSBYTE D0- Econet OSWRCH interception flag (bit 7)
0261      :(50) -OSBYTE D1- speech enable/disable flag (50/20)
0262      :(00) -OSBYTE D2- sound output enable flag
0263      :(03) -OSBYTE D3- BELL channel number
0264      :(90) -OSBYTE D4- BELL amplitude/ENVELOPE number
0265      :(64) -OSBYTE D5- BELL frequency
0266      :(06) -OSBYTE D6- BELL duration
0267      :(81) -OSBYTE D7- bit 7 set = ignore startup message,
          :                 bit 0 set = ignore RFS !BOOT error
0268      :(00) -OSBYTE D8- length of key string
0269      :(00) -OSBYTE D9- PRINT line counter
026A      :(00) -OSBYTE DA- number of items in VDU queue (2s complement of
          :                 number required)
026B      :(09) -OSBYTE DB- TAB key value
026C      :(1B) -OSBYTE DC- ESCAPE character
026D      :(01) -OSBYTE DD- input buffer code interpretation status (C0-CF)
026E      :(D0) -OSBYTE DE- input buffer code interpretation status (D0-DF)
026F      :(E0) -OSBYTE DF- input buffer code interpretation status (E0-EF)
0270      :(F0) -OSBYTE E0- input buffer code interpretation status (F0-FF)
0271      :(01) -OSBYTE E1- keyboard buffer code interpretation status (80-8F)
0272      :(80) -OSBYTE E2- input buffer code interpretation status (90-9F)
0273      :(90) -OSBYTE E3- input buffer code interpretation status (A0-AF)
0274      :(00) -OSBYTE E4- input buffer code interpretation status (B0-BF)
          :                 0 - ignore key, 1 - expand as normal key, 2-FF -
          :                 add to base for ASCII code, default on BRK - CA
0275      :(00) -OSBYTE E5- ESCAPE key status (0 - ESC, 1 - ASCII)
0276      :(00) -OSBYTE E6- ESCAPE action
0277      :(FF) -OSBYTE E7- user 6522 VIA IRQ bit mask
0278      :(FF) -OSBYTE E8- 6850 ACIA IRQ bit mask
0279      :(FF) -OSBYTE E9- MOS 6522 VIA IRQ bit mask
027A      :(00) -OSBYTE EA- TUBE presence flag
027B      :(00) -OSBYTE EB- speech processor presence flag
027C      :(00) -OSBYTE EC- character destination status
027D      :(00) -OSBYTE ED- cursor EDITING status
027E      :(00) -OSBYTE EE- not used
027F      :(00) -OSBYTE EF- not used
0280      :(00) -OSBYTE F0- not used
0281      :(00) -OSBYTE F1- user flag

0282      :(64) -OSBYTE F2- serial ULA control register setting
0283      :(05) -OSBYTE F3- current system clock store pointer
0284      :(FF) -OSBYTE F4- soft key status flag (0 = stable)
0285      :(01) -OSBYTE F5- printer destination
0286      :(0A) -OSBYTE F6- printer-ignore character
0287      :(00) -OSBYTE F7- BRK interception flag - (4C - JMP opcode)
0288      :(00) -OSBYTE F8- user BRK routine address lo
0289      :(00) -OSBYTE F9- user BRK routine address hi
028A      :(00) -OSBYTE FA- not used
028B      :(00) -OSBYTE FB- not used
028C      :(FF) -OSBYTE FC- current language ROM page
028D      :     -OSBYTE FD- last BREAK type (0 - soft, 1 - powerup, 2 - hard)
028E      :     -OSBYTE FE- available RAM (40 - 16K, 80 - 32K)
028F      :     -OSBYTE FF- startup options set by keyboard links
          :                 bits 0-2 screen MODE, bit 3 reset - reverse
          :                 SHIFT+BRK, bits 4,5 disc drive timing parameters
0290      :screen display vertical adjustment
0291      :interlace toggle flag
0292-0296 :system clock 1
0297-029B :system clock 2
029C-02A0 :countdown interval timer buffer
02A1-02B0 :paged ROM type table
02B1-02B2 :INKEY countdown timer
02B3-02C7 :OSWORD 1 workspace
02B6-02B9 :lo bytes of most recent analogue conversion value
02BA-02BD :hi bytes of most recent analogue conversion value
02BE      :analogue system flag (OSBYTE 80)
02B3      :maximum input line length (OSWORD 0)
02B4      :minimum input ASCII code (OSWORD 0)
02B5      :maximum input ASCII code (OSWORD 0)
02BF-02C8 :EVENT enable flags
02C9      :soft key expansion pointer
02CA      :first autorepeat count
02CB-02CD :key-pressed processing workspace
02CE      :ENVELOPE processing software status
02CF-02D7 :buffer busy flags
02D8-02E0 :buffer start indices
02E1-02E9 :buffer end indices
02EA-02EB :CFS currently resident block input size
02EC      :block flag of currently resident block
02ED      :last character, currently resident block, CFS input file
02EE-02FF :OSFILE control block workspace
```

VDU VARIABLES STORE AND WORKSPACE

```
0300-0301 :current graphics window left-hand column (pixels)
0302-0303 :                        bottom row
0304-0305 :                        right-hand column
0306-0307 :                        top row
0308      :current text window left-hand column (characters from text origin)
0309      :                      bottom row
030A      :                      right-hand column
030B      :                      top row
030C-030F :current graphics origin (external coordinates)
0310-0313 :current graphics cursor (external coordinates)
0314-0317 :old graphics cursor (external coordinates)
0318-0319 :current text cursor (X,Y)
031A      :line in current graphics cell containing current graphics point
031B-0323 :VDU queue
031B-031E :graphics workspace
0324-0327 :current graphics cursor (internal coordinates)
0328-0349 :graphics coordinate workspace
0332-0333 :VDU branch routine vectors
034A-034B :text cursor position (6845 address registers)
034C-034D :text window width (bytes)
034E      :bottom of screen memory address hi
034F      :character size (bytes) for current MODE
0350-0351 :screen top left-hand corner 6845 address
0352-0353 :number of bytes/character row
0354      :screen memory size hi
0355      :current screen MODE
0356      :screen display type
0357      :foreground text colour
0358      :background text colour
0359      :foreground graphics colour
035A      :background graphics colour
035B      :foreground graphics PLOT mode
035C      :background graphics PLOT mode
035D-035E :VDU routine vector
035F      :6845 cursor start register old setting
0360      :number of logical colours -1 in current MODE
0361      :number of pixels/byte -1 in current MODE (0=text)
0362      :left colour mask
0363      :right colour mask
0364-0365 :text input cursor coordinates (X,Y)
0366      :MODE 7 cursor character
0367      :font flag
0368-037E :font location address hi
036F-037E :colour palette
```

CFS/RFS VARIABLES STORE

```
0380-039C :BPUT file header block
039D      :BPUT buffer offset for next byte
039E      :BGET buffer offset for next byte
039F-03A6 :unallocated
03A7-03B1 :BGET filename
03B2-03D0 :most recent block header
03B2-03BD :    filename
03BE-03C1 :    load address
03C2-03C5 :    execution address
03C6-03C7 :    block number
03C8-03C9 :    block length
03CA      :    block flag
03CB-03CE :    RFS EOF +1
03CF-03D0 :    checksum
03D1      :sequential block gap
03D2-03DC :sought filename
03DD-03DE :expected BGET file block number
03DF      :copy of last read block flag
```

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KEYBOARD INPUT BUFFER

```
03E0-03FF :keyboard input buffer
```

TUBE COMMUNICATIONS ROUTINES

```
0400      :TUBE language entry point
0403      :TUBE service entry point
0406      :TUBE data transfer entry point
```

SOUND QUEUES AND WORKSPACE

```
0800-0803 :unallocated
0804-0837 :sound queues
0804-0807 :sound queue occupancy flag
0808-080B :           current amplitude, this channel
080C-080F :           number of amplitude phases processed
0810-0813 :           absolute pitch value
0814-0817 :           number of pitch phases processed
0818-081B :           number of steps to process
081C-081F :           duration
0820-0823 :           interval multiplier
0824-0827 :           ENVELOPE number / autorepeat parameter
0828-082B :           length of note interval left
082C-082F :           sync hold parm
0830-0833 :           sound chip current pitch setting
0834-0837 :           pitch deviation
0838      :number of channels required for sync
0839      :current amplitude step
083A      :current target amplitude
083B      :number of channels on hold for sync
083C-083F :sound parameter calculation workspace
083D      :lo order frequency parameter sent to sound generator
083E      :hi order frequency parameter sent to sound generator
```

BUFFERS

```
0840-084F :sound buffer channel #0
0850-085F :                     #1
0860-086F :                     #2
0870-087F :                     #3
0880-08BF :printer buffer
08C0-08FF :ENVELOPE store (#1-4)
0900-09BF :ENVELOPE store extension (#5-16)
09C0-09FF :speech buffer
0900-09BF :RS432 output buffer
0900-09FF :CFS output buffer
0A00-0AFF :RS432 input buffer
0A00-0AFF :CFS input buffer
0B00-0BFF :soft key buffer
0C00-0CFF :characters E0-FF - font store
```

NMI ROUTINES

```
0D00-0D9E :NMI routines
```

PAGED ROM VARIABLES STORE

```
0D9F-0DEF :paged ROM expanded vector set
0DF0-0DFF :paged ROM private workspace address hi
```

PC

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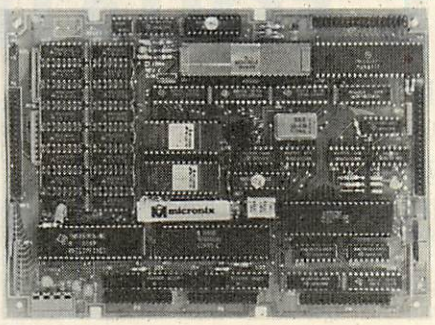

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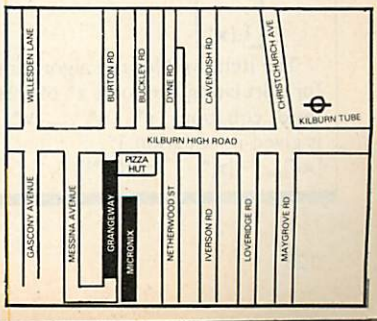

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SOLVING NON-LINEAR SIMULTANEOUS EQUATIONS

Solving non-linear equations presents some special difficulties. Bill Hill tackles the problem with a development of Newton's method, implemented as an Applesoft program.

MANY PRACTICAL engineering and business problems require the solution of a set of equations that are non-linear functions of the unknown variables. In other words, the equations of the n unknown variables $x_1, x_2, x_3, \ldots x_n$. The conventional numerical for simultaneous linear equations such as Gaussian elimination and the Gauss-Jordan method, cannot be used if this is the case.

The solution of a set of simultaneous non-linear equations may at first seem daunting, but a very simple technique is available to help. It is the multi-variable equivalent of the well-known iterative Newton method for finding the roots of the single algebraic equation $f(x) = 0$. You may be surprised to learn that a Basic program of only about 100 lines can solve most non-linear simultaneous equation problems.

Suppose there are n equations of form:

$$f_1(x_1, x_2, \ldots x_n) = 0$$
$$f_2(x_1, x_2, \ldots x_n) = 0$$
$$\vdots$$
$$f_n(x_1, x_2, \ldots x_n) = 0$$

In other words, $f_1 \ldots f_n$ are functions of all or some of the unknown variables. The less cluttered notation $\mathbf{f(x)} = \mathbf{0}$ can be used to represent the above set of equations, where the bold type signifies a column or vector of variables or functions. For example $\mathbf{x}$ is

$$\begin{bmatrix} x_1 \\ x_2 \\ \vdots \\ x_n \end{bmatrix}$$

and $\mathbf{f(x)}$ is

$$\begin{bmatrix} f_1(\mathbf{x}) \\ f_2(\mathbf{x}) \\ \vdots \\ f_n(\mathbf{x}) \end{bmatrix}$$

The iterative Newton algorithm for calculating the roots x^* of this set of equations, $x^*_1, x^*_2, \ldots x^*_n$, is given in equation 1:

$$[\mathbf{x}^*]_{k+1} = [\mathbf{x}^* - J^{-1}\mathbf{f}(\mathbf{x}^*)]_k$$

with k equal to 0,1,2,3..., and where J is an n by n matrix called the Jacobian matrix. It is the multi-variable equivalent of the derivative $df(x)/dx$ in the single-variable case. The element J_{ij} of the Jacobian matrix is defined as a partial derivative

$$J_{ij} = \partial f_i / \partial x_j$$

An initial guess $[x^*]_0$ is used to calculate $[x^*]_1$, which in turn is used to calculate $[x^*]_2$, and so on until the values of the respective elements in the vectors $[\mathbf{x}^*]_k$ and $[\mathbf{x}^*]_{k+1}$ are very close or identical.

Now $f(x)$ may be a set of complicated non-linear functions, and it may therefore be difficult to evaluate the equations for the elements of the Jacobian matrix analytically. To make life easier, an approximation to the partial derivatives can be used in a program. For example, for J_{11} use

$$(f_1(x_1+\Delta x_1, x_2, x_3, \ldots x_n) - f_1(x_1, x_2, x_3, \ldots x_n))/\Delta x_1$$

for J_{21} use

$$(f_2(x_1+\Delta x_1, x_2, x_3, \ldots x_n) - f_2(x_1, x_2, x_3, \ldots x_n))/\Delta x_1$$

for J_{12} use

$$(f_1(x_1, x_2 + \Delta x_2, x_3, \ldots x_n) - f_1(x_1, x_2, x_3, \ldots x_n))/\Delta x_2$$

and so on for the other elements of the J matrix. For these approximations to be reasonable, Δx_1, $\Delta x_2, \ldots \Delta x_n$ should be relatively small values, so I have used $x_1/100$, $x_2/100, \ldots x_n/100$ in the program.

Once the program has evaluated the J matrix at each iteration, it must calculate the inverse matrix J^{-1} and then calculate the product of J^{-1} and $[f(x^*)]_k$. This can be done more easily by solving for $y_1, \ldots y_n$ in the following set of linear simultaneous equations at each iteration:

$$[J\mathbf{y}]_k = [-\mathbf{f}(\mathbf{x}^*)]_k \qquad \text{equation (2)}$$

Once the values of the elements $y_1, \ldots y_n$ of the vector y have been calculated, the values of the elements of the $[x^*]_{k+1}$ vector for the next iteration are given by:

$$[\mathbf{x}^*]_{k+1} = [\mathbf{x}^* + \mathbf{y}]_k \quad \text{equation (3)}$$

The whole process is repeated until the values of $y_1, \ldots y_n$ are very small or zero, at which point the values of the elements of the $[x^*]_{k+1}$ vector are the required solution.

Listing 1 shows an Applesoft program to solve a set of simultaneous non-linear or linear equations using Newton's method. The elements of the y vector at each iteration are calculated using the Gauss-Jordan method; see references 1 and 2 for a description of this method. I have added a row-swapping subroutine to the standard Gauss-Jordan routine so that the program will not fail from a division by zero error if a pivot element becomes zero even though a solution exists.

The functions given as an example in the subroutine starting at line 1000 are for the following non-linear equations with three unknowns — see reference 2:

$$3x_1 - \cos(x_2 x_3) - 0.5 = 0$$
$$x_1^2 - 81(x_2 + 0.1)^2 + \sin(x_3) + 1.06 = 0$$
$$\exp(-x_1 x_2) + 20x_3 + (10\pi - 3)/3 = 0$$

Before commencing the iterations the program asks for an accepted tolerance value; that is, the total tolerable error in the calculated roots, subject to the limitations for Applesoft's finite arithmetic. You must also input initial guesses for $x^*_1, \ldots x^*_n$ when prompted.

If a tolerance value of 0.0001 and initial guesses of 1.0 for all three unknowns are used in this example, the routine converges to the following solution in seven iterations:

$$x^*_1 = 0.500000004$$
$$x^*_2 = -3.9690562E-09$$
$$x^*_3 = -0.523598776$$

In fact x^*_1 should be exactly 0.5 and x^*_2 should be exactly zero. The slight differences are due to the finite arithmetic of Applesoft. If your Basic supports double-precision arithmetic your answer could be more accurate.

You can substitute your own set of non-linear or linear equations in the subroutine after line 1000, and the number of equations is limited only by the available memory. In this subroutine use the one-dimensional array X to represent the unknowns, and the one-dimensional array F to represent the functions.

As an example of how the method could be used, consider the following problem. John, David and Martin are three brothers. The sum of the squares of the brothers' ages equals 1,914. The sum of their ages is 72, and if Martin's age is divided by David's age the result equals John's age divided by 10 and added to the reciprocal of David's age.

The first thing to do is to write the puzzle in algebraic form. Let the ages of the three brothers be represented by the unknowns J, D and M. Using these symbols you can write:

$$J^2 + D^2 + M^2 = 1914$$
$$J + D + M = 72$$
$$M/D = J/10 + 1/D$$

To use these three equations in the program the three unknown ages can be specified X(1), X(2) and X(3). The equations are arranged so that the right-hand sides are all zero; the left-hand sides are therefore the three functions F(1), F(2) and F(3) that are needed for the subroutine beginning on line 1000 of the program. For example, the above three equations can be arranged as

```
X(1)*X(1)+X(2)*X(2)+X(3)*X(3)
-1914=0
X(1)+X(2)+X(3)-72=0
X(1)*X(2)-10*(X(3)-1)=0
```

so that you can put the following lines in the program

```
1010 F(1)=X(1)*X(1)+X(2)*X(2)
  +X(3)*X(3)-1914
1020 F(2)=X(1)+X(2)+X(3)-72
1030 F(3)=X(1)*X(2)-10*(X(3)
  -1)
1040 RETURN
```

Now run the program and specify an error tolerance of, say, 0.0001 and initial guesses of 1 for all three brothers' ages. The program will display the following message:

NO UNIQUE SOLUTION FOR Y EXISTS

This means either that there is no unique solution for the puzzle, or that the guesses are too far out. To see if the latter is the case, try running the program again, but this time use 15 as a guess for all the ages. This time the program will begin to print to the iterations until, lo and behold, it stops after 34 iterations and displays the three brothers' ages.

```
]LIST

1  REM  ITERATIVE NEWTON SOLUTION

2  REM  OF COUPLED ALGEBRAIC EQUA
     TIONS
3  REM  BY BILL HILL, JAN. 85
4  REM  ************************
     *******
5  REM  ALWAYS CHECK RESULTS, AND
      DO NOT
6  REM  FORGET THAT ROUNDING ERRO
     RS MAY
7  REM  PRODUCE INCORRECT RESULTS

8  REM  ************************
     *******
9  PRINT
10  INPUT "INPUT NO. OF EQUATIONS
     ";N
20  PRINT
30  INPUT "INPUT TOLERANCE ";TL
40  PRINT
50  INPUT "INPUT MAX. NO. OF ITER
     ATIONS ";IM
60  PRINT
70  DIM X(N),F(N),G(N),J(N,N + 1)

80  PRINT "INPUT INITIAL GUESS"
90  PRINT
100  FOR I = 1 TO N
110  PRINT "X(";I;") ";: INPUT X(
     I)
120  NEXT I
130  PRINT
140 K = 1
150  REM  REPEAT DOWN TO LINE 690
      UNTIL EITHER IM IS EXCEEDED
      OR SOLUTION CONVERGES
160  GOSUB 1000: REM  CALC. F
170  REM  SET G=F
180  FOR I = 1 TO N
190 G(I) = F(I)
200  NEXT I
210  REM  CALC. JACOBIAN MATRIX A
     PPROX.
220  FOR I = 1 TO N
230 P =  ABS (X(I)) / 100
240 X(I) = X(I) + P
250  GOSUB 1000: REM  CALC. F
260  FOR L = 1 TO N
270 J(L,I) = (F(L) - G(L)) / P
280  NEXT L
290 X(I) = X(I) - P
300  NEXT I
310  REM  SOLVE FOR Y VECTOR IN J
     Y=-G USING GAUSS-JORDAN ROUT
     INE
320  FOR I = 1 TO N
330 J(I,N + 1) =  - G(I)
340  NEXT I
350  FOR R = 1 TO N
360 DI = J(R,R)
370  IF DI = 0 AND R = N
     THEN  PRINT "NO UNIQUE
     SOLUTION FOR Y EXISTS": END
380  IF DI = 0 THEN  GOSUB 700
390  IF DI = 0 THEN  GOTO 360
400  FOR H = 1 TO (N + 1)
410 J(R,H) = J(R,H) / DI
420  NEXT H
430  FOR S = 1 TO N
440 Q = J(S,R)
450  IF S = R THEN  GOTO 490
```

(continued on next page)

(continued from previous page)

```
460  FOR T = 1 TO (N + 1)
470 J(S,T) = J(S,T) - J(R,T) * Q
480  NEXT T
490  NEXT S
500  NEXT R
510  REM  END OF GAUSS-JORDAN ROU
     TINE
520  REM  (N+1)TH COL. OF J IS SO
     LUTION FOR Y
530  FOR I = 1 TO N
540 X(I) = X(I) + J(I,N + 1)
550  NEXT I
560 SU = 0
570  FOR I = 1 TO N
580 SU = SU +  ABS (J(I,N + 1))
590  NEXT I
600  REM  PRINT X
610  PRINT "ITERATION NO. ";K
620  FOR I = 1 TO N
630  PRINT "X(";I;") = ";X(I)
640  NEXT I
650  PRINT
660  IF SU < TL THEN  END
670 K = K + 1
680  IF K > IM THEN  PRINT "MAX.
     NO. OF ITERATIONS EXCEEDED":
      END
690  GOTO 160
700  REM  SUBROUTINE TO SWOP ROWS

710  REM  IF PIVOT ELEMENT IS ZER
     O
720  REM  IN GAUSS-JORDAN ROUTINE
     .
730  REM  (BUT FIRST CHECK IF RES
     T
740  REM  OF COLUMN IS ALL ZEROS
     )
750 W1 = 0
760  FOR II = (R + 1) TO N
770  IF W1 = 0 AND J(II,R) <  > 0
      THEN  LET W1 = II
780  NEXT II
790  IF W1 = 0 THEN  PRINT "NO UN
     IQUE SOLUTION FOR Y EXISTS":
      END
800  REM  NOW SWOP ROW R WITH ROW
      W1
810  FOR II = 1 TO (N + 1)
820 W2 = J(R,II)
830 J(R,II) = J(W1,II)
840 J(W1,II) = W2
850  NEXT II
860  RETURN
1000  REM  SUBROUTINE F(X)
1010 F(1) = 3 * X(1) -  COS (X(2)
      * X(3)) - 0.5
1020 F(2) = X(1) ^ 2 - 81 * (X(2)
      + 0.1) ^ 2 +  SIN (X(3)) +
     1.06
1030 F(3) =  EXP ( - X(1) * X(2))
      + 20 * X(3) + (31.41592654 -
     3) / 3
1040  RETURN
```

REFERENCES

1. A Gauss-Jordan Elimination Method Program by P E McGuire, *Byte,* August 1983.
2. *Numerical Analysis* second edition by R Burden, J Faires, A Reynolds. Published by Prindle, Weber & Schmidt, Boston 1981.

You might also like to take a look at *An Introduction to Numerical Methods for Differential Equations* by J Ortega and W Poole, published by Pitman, 1981, which discusses the Newton Method and its use in routines for solving differential equations. This book also illustrates some of the problems that can occur with the Newton method. PC

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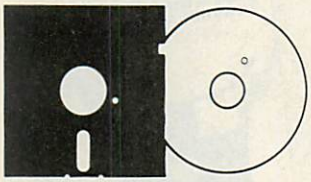

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MD-2F	Double side/Quad density	96	5536	80	1,000,000

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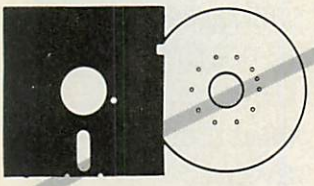
10 HARD SECTOR



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MD-210D	Double side/Double density	48	5536	40	500,000
MD-110F	Single side/Quad density	96	5536	80	500,000
MD-210F	Double side/Quad density	96	5536	80	1,000,000

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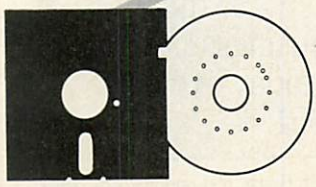

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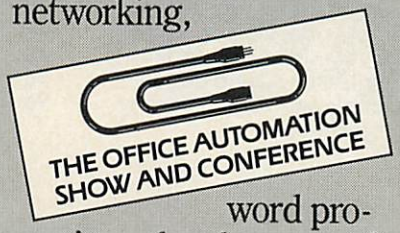

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PRINTING IN TYPEWRITER MODE

Turning your sophisticated micro/printer setup into nothing more or less than an electric typewriter may seem perverse, but it can have its uses. John and Timothy Lee present a routine to do the trick.

EVEN IF you use a word processor for most of your work, there are certain jobs that it does not handle very conveniently. For example, typing the address on a sticky label or an envelope may be a considerable fiddle, and typing information into boxes on pre-printed forms may be nearly impossible. It may be more bother than it is worth to type a short letter, note or memo on the word processor.

Possibly you have just a computer and printer, and would like to use it to type an important letter. Perhaps you have friends or relatives who are intimidated by computers, but would be happy to use an electronic typewriter that is as easy to use as a Selectric.

If you fall into any of these categories, then the CP/M utility program Typewrit.Com is for you. Even the most timid beginner can learn to use it in a couple of minutes. It works with any eight-bit CP/M machine, and can print from any type of printer.

To run the program, simply type Typewrit. Helpful messages are displayed on the screen:

```
Program to send keyboard output
  directly to the printer.
Please switch on the printer and
  press Return.
```

when you have done this, the next message appears:

```
Type sufficient spaces to move the
  print head to the first column
  that you wish to print in. Then
  press Return.
```

In this way you can adjust the left margin on the printer, and this will be remembered, however many lines you type. When you have done this, the next message appears:

```
Now type directly onto the printer.
  At the end of each line hit
  Return, and the printer will
  return to your initial column.
  Type Control-C to quit.
```

As you type text, it is displayed on the screen, and is printed simultaneously. You must press Return at the end of each line, just as on a typewriter. When the task is complete, you type Control-C to leave the program and return to CP/M.

If your printer supports backspacing, then after typing a line but before pressing Return you can use the Delete key on the keyboard to delete characters from the screen, or the backspace key, Control-H, to move the cursor one character to the left. Both of these keys should move the print head back a character, but of course characters cannot be deleted once they have been printed on the paper. However, this method is useful for underlining, and for producing double-struck print.

It is possible to run the Typewrit program while you are using WordStar. Simply select the R option to run a program, and then type

TYPEWRIT

This may be convenient for addressing an envelope while the main job is done on the word processor.

The program is written in Intel 8080 code so that it can be assembled using the standard CP/M-80 assembler ASM. To do this you should type the 8080 mnemonics and comments for the program into a file called Typewrit.ASM. Do not type in the first two columns of the listing, but start instead at the column occupied by the ; in the first line. Assemble the source file by typing

ASM TYPEWRIT

which will produce a hexadecimal file called Typewrit.Hex and a listing file called Typewrit.PRN which should be identical to the listing.

The .Hex file must be loaded to produce an executable .Com file by typing

LOAD TYPEWRIT

You should then have a working file called Typewrit.Com which can be run by typing

TYPEWRIT

The two intermediate files Typewrit.Hex and Typewrit.PRN can be deleted.

TYPEWRIT.COM

```
                ;       Program to allow for direct typing onto a printer.
                ;       Typically used for addressing envelopes.
                ;
0000 =          REBOOT  EQU     0       ;CP/M Reboot address
0005 =          CPM     EQU     5       ;Call address for CP/M functions
                ;
000D =          CR      EQU     0DH     ;ASCII Carriage Return code
000A =          LF      EQU     0AH     ;ASCII LineFeed Character

0100            ORG     100H

0100 C3A901             JMP     START

0103 0D0A0A2A2A         DB      CR,LF,LF, '***  TYPEWRITER.ASM version 1.2  ***'
012A 0D0A0A2A2A         DB      CR,LF,LF, '***  Program to allow for direct typing '
0155 6F6E746F20         DB      'onto a printer  ***'
0168 0D0A2A2A2A         DB      CR,LF, '***  written by T.D. Lee                '
0191 3132204A61         DB      '12 January 1984  ***'
01A5 0D0A0A1A           DB      CR,LF,LF, 26

01A9 31F603     START:  LXI     SP,STACK
01AC 112F02             LXI     D,SIGNON
01AF CD2902             CALL    MESAGE          ;Display Signon Message
                ;
01B2 CD1802     PRON:   CALL    GETCHR
01B5 FE0D               CPI     CR              ;wait until <CR> is typed
01B7 C2B201             JNZ     PRON
                ;
01BA 3E0D               MVI     A,CR
01BC CD2002             CALL    PRINT           ;Move Print Head to left margin.
                ;
01BF 11A002             LXI     D,SUFFSP
01C2 CD2902             CALL    MESAGE          ;Display "Type sufficient spaces"
                ;
                ;       Position print head by typing spaces
                ;
01C5 2E00               MVI     L,0
01C7 CD1802     SPACES: CALL    GETCHR
01CA FE0D               CPI     CR
01CC CADB01             JZ      ENDSPA          ;Stop if <CR> received
01CF FE20               CPI     ' '
01D1 C2C701             JNZ     SPACES          ;ignore non space chars
01D4 CD2002             CALL    PRINT           ;Send space to Printer and Screen
01D7 2C                 INR     L               ;Count number of spaces
01D8 C3C701             JMP     SPACES
                ;
01DB 7D         ENDSPA: MOV     A,L
01DC 32B503             STA     NSPACE          ;Store number of spaces
                ;
01DF 111703             LXI     D,TYPMES
01E2 CD2902             CALL    MESAGE          ;Display "Type onto the printer"
01E5 CD1802     MAINLP: CALL    GETCHR
01E8 FE03               CPI     3
01EA CA0000             JZ      REBOOT          ;Finish if ^C typed
01ED FE0D               CPI     CR
01EF CAF801             JZ      GOTCR           ;Jump if <CR>
01F2 CD2002             CALL    PRINT           ;else ECHO Character
01F5 C3E501             JMP     MAINLP          ;and repeat
                ;
01F8 3E0D       GOTCR:  MVI     A,CR
01FA CD2002             CALL    PRINT
01FD 3E0A               MVI     A,LF            ;Send <CR> <LF> to printer
01FF CD2002             CALL    PRINT
                ;
0202 3AB503             LDA     NSPACE
0205 6F                 MOV     L,A             ;L = Number of spaces required
0206 3E20       GOTCR2: MVI     A,' '
0208 CD2002             CALL    PRINT           ;Print a space
020B 2D                 DCR     L
020C C20602             JNZ     GOTCR2          ;Repeat until L done
                ;
020F 11B203             LXI     D,CRLF
0212 CD2902             CALL    MESAGE          ;<CR> <LF> to screen
0215 C3E501             JMP     MAINLP
                ;
                ;       Utitily Subroutines
                ;
0218 E5         GETCHR: PUSH    H               ;Get a character from the keyboard
0219 0E01               MVI     C,1
021B CD0500             CALL    CPM
021E E1                 POP     H
021F C9                 RET
                ;
0220 5F         PRINT:  MOV     E,A             ;Send character in A to the printer
0221 E5                 PUSH    H
0222 0E05               MVI     C,5
0224 CD0500             CALL    CPM
0227 E1                 POP     H
0228 C9                 RET
                ;
0229 0E09       MESAGE: MVI     C,9             ;Print a string on the screen
022B CD0500             CALL    CPM
022E C9                 RET
                ;
                ;       Messages
                ;
022F 0D0A0A5072SIGNON: DB       CR,LF,LF, 'Program to send keyboard characters '
0256 6469726563         DB      'directly to the printer.'
026E 0D0A506C65         DB      CR,LF, 'Please switch on the printer and press RETURN. $'
                ;
02A0 0D0A0A5479SUFFSP: DB       CR,LF,LF, 'Type sufficient spaces to move the print '
02CC 6865616420         DB      'head to the first column'
02E4 0D0A746861         DB      CR,LF, 'that you wish to print in.  '
0302 5468656E20         DB      'Then press RETURN.', CR,LF, '$'
                ;
0317 0D0A0A4E6FTYPMES: DB       CR,LF,LF, 'Now type directly onto the printer. '
033E 4174207468         DB      'At the end of each line hit RETURN'
0360 0D0A616E64         DB      CR,LF, 'and the printer will return to your initial '
038E 636F6C756D         DB      'column.  Type ^C (Control-C) to quit'
03B2 0D0A24     CRLF:   DB      CR,LF,'$'
                ;
03B5 00         NSPACE: DB      0
                ;
03B6                    DS      64
```

TOGGLING

FROM TIME to time you may want to toggle the cassette-motor relay on and off to rewind cassettes during a running program. Normally you have to unplug the DIN connector to do this, but it would be better if you could control this function straight from the keyboard. You might also want to switch the sound off or on from within a running game.

To achieve these tasks Stuart Moore has written a program which uses event handling to intercept a keypress. He chose the Ctrl-Shift-function key combination as one which is unlikely to have been designated for any other purpose.

There is a half-second delay between successive acceptances of the same keypress to avoid fast repeat settings from damaging the relays. Though this uses the interval timer, it is only read from, not written to, and the time processes in the main program should not be affected.

Assemble the code into any free area of memory below Page: say, &900. After assembly the machine code can be saved directly with

*SAVE toggle 900 9C4

The individual routines can be accessed directly with a call: &988 for cassette relay and &99B for sound. To reinstate the code and execute it just type

*toggle

POLYNOMIAL

A PROGRAM that fits an nth-degree polynomial curve to set a set of data points has been devised by D Guy. Up to 12 pairs of X and Y values can be entered, and the degree of polynomial selected from 1 to 5, or one less than the number of points entered, whichever is less.

The routine also includes a graph space on to which the data and curve are plotted. Additional fits can also be plotted on the same graph, which can be cleared if it becomes too cluttered.

Care must be taken when interpreting the question for X,Y max limits. This refers to the limits on the graph. Otherwise the program is easy to use.

TOGGLING

```
  100 REM S.W.Moore 1985
  170 REM Sets up <SHIFT><CTRL>f0 t
o
  180 REM toggle the CASSETTE MOTOR
  190 REM relay and <SHIFT><CTRL>f1
 to
  200 REM toggle the sound ON/OFF
  210 REM
  220 REM The choice of locations i
s
  230 REM fairly arbitrary. D1F to
D23
  240 REM within the code are used
to
  250 REM store a copy of the syste
m
  260 REM timer contents. F8 and F9
 in
  270 REM zero page (old EVNTV) and
  280 REM 28A,28B for two low bytes
 of
  290 REM last clock value checked
are
  300 REM not used by OS 1.2
  310 REM
  320 FOR I%=0 TO 2 STEP 2
  330 P%=&D01
  340 [OPT I%
  350 LDA &220    \Store the existin
g
  360 STA &F8     \EVNTV in zero pag
e
  370 LDA &221    \Low then high byt
e
  380 STA &F9
  390 LDA #start MOD &100
  400 STA &220    \Replace with addr
ess
  410             \of this routine
  420 LDA #start DIV &100
  430 STA &221
  440 LDA #14     \Now initiate the
KEY
  450 LDY #0      \PRESSED event wit
h
  460 LDX #2      \OSBYTE 14 and X=2
  470 JSR &FFF4
  480 RTS
  490 .time
  500 BRK:BRK     \Dummy locations f
or a
  510 BRK:BRK     \copy of the syste
m
  520 BRK         \timer contents
  530 .start
  540 PHP         \Push processor st
atus
  550 CMP #2      \Is this event 2?
  560 BEQ yes
  570 PLP
  580 JMP (&F8)   \No; go to normal
event
  585             \handling routine
  590 .yes
  600 PHA         \Yes; Save registe
rs
  610 TXA
  620 PHA
  630 TYA
  640 PHA         \Code of key press
ed
  650 CMP #&B0    \Is it SHIFT-CTRL-
f0
  660 BCS next    \or greater; try n
ext
  670 JMP exit    \no; take ordered
exit
  680 .next
  690 CMP #&B2    \higher than targe
t key
  700 BCC timchk \SHIFT-CTRL-f0 or
-f1
  705             \if less so branch
  710 JMP exit    \If higher, exit
  720 .timchk
  730 LDX #time MOD &100
  740 LDY #time DIV &100
  750 LDA #1      \OSWORD call to pu
t 5
  760 JSR &FFF1   \System clock byte
s in
  770 LDA time    \RAM; get low byte
  780 SEC
  790 SBC &28A    \subtract chkbyte(
L)
  800 STA time+3 \and save result
  810 LDA time+1 \Get next byte
  820 SBC &28B    \subtract chkbyte(
H)
  830 STA time+4 \and save result
  840 CMP #1      \Test result
  850 BCS ok      \>=1;more than 2.5
5s
  860 LDA time+3 \test low byte res
ult
  870 CMP #50     \against 50 csec
  880 BCC exit    \not long enough;b
ranch
  890 .ok
  900 LDA time    \Put current time
into
  910 STA &28A    \chkbyte(L,H)
  920 LDA time+1
  930 STA &28B
  940 PLA         \get key pressed c
ode
  950 PHA         \from stack
  960 .first
  970 CMP #&B0    \is it SHIFT-CTRL-
f0?
  980 BNE second \No; test the next
  990 JSR motor   \To RELAY routine
 1000 JMP exit
 1010 .second
 1020 CMP #&81    \is it SHIFT-CTRL-
f1?
 1030 BNE out
 1040 JSR noise   \Sound ON/OFF rout
ine
 1050 .out
 1060 JMP exit
 1070 .motor
 1080 LDA &282    \OS relay status b
yte
 1090 ASL A       \Get the highest b
it
 1100 BCC swon    \0 so can switch o
n
 1110 .swoff      \1 so switch off
 1120 LDX #0
 1130 JMP switch1
 1140 .swon
 1150 LDX #1
 1160 .switch1
 1170 LDA #137    \MOTOR Osbyte call
 1180 JSR &FFF4
 1190 RTS
 1200 .noise
 1210 LDX #0
 1220 LDY #&FF
 1230 LDA #210    \Set X,Y to read S
ound
 1240 JSR &FFF4   \status
 1250 CPX #0
 1260 BEQ disable\Enabled, so branc
h
 1270 .enable
 1280 LDX #0      \Disabled, so
 1290 LDY #0      \enable it
 1300 JSR &FFF4
 1310 LDA #7
 1320 JSR &FFEE   \Beep
 1330 RTS
 1340 .disable
 1350 LDX #&FF    \Enabled, so
 1360 LDY #0      \disable it
 1370 JSR &FFF4
 1380 RTS
 1390 .exit
 1400 PLA         \Restore registers
 1410 TAY
 1420 PLA
 1430 TAX
 1440 PLA
 1450 PLP
 1460 RTS
 1470 ]
 1480 NEXT I%
 1490 CALL&D01
 1500 *KEY10CALL&D01|M
```

POLYNOMIAL

```
   10 REM POLYNOMIAL CURVE FIT
   20 REM By D G K GUY February 198
5
   30 MODE7
   40 FORL=1TO2:PRINTTAB(6);CHR$(14
1);"POLYNOMIAL CURVE FITTING":NEXT:
   50 PRINT'"This program accepts u
p to 12 sets of"'"X & Y data points
 and plots these on a"'"graph whose
 full scale can be chosen"'"to suit
.  The user then selects the"
   60 PRINT"degree of polynomial re
quired."'"The program then calculat
es and prints"'"the co-efficients,
then plots the"'"corresponding curv
e on the graph."'"Then :-"''
   70 PRINTTAB(5)"f0 - allows anoth
er degree to be"'"          chosen.
"
   80 PRINTTAB(5)"f1 - clears the g
raph but leaves"'"          the ori
ginal points."
   90 PRINTTAB(5)"f2 - starts the p
rogram again."
  100 INPUTTAB(5,22)"Press any key
to continue ",:K=GET
  110 column=0:MODE4
  120 *FX225,200
  130 VDU23,1,0;0;0;0;
  140 DEFFNA(X)=INT(X*100+.5)/100
  150 PRINTTAB(30,0);"X";TAB(36,0);
"Y"
  160 PRINTTAB(28,1);"-----------"
  170 VDU24,0;350;800;965;
  180 PROCaxes
  190 PROCtable
  200 PROCgetdata
  210 NN=N:IFNN>5 NN=6
  220 @%=10:PROCwindow2
  230 PRINT'"Degree of polynomial (
1 to ";NN-1;")";
  240 INPUT,D:IFD>=N OR D>5 ORD<1TH
EN220
  250 PROCpolynomial
  260 PROCtabfunction
  270 PROCplotfunction
  280 PROCwindow2
  290 PRINT"f0-replot. f1-clear gra
ph. f2-re run";
  300 K=GET
  310 IFK=200 THEN220 ELSEIFK=201 P
ROCreplot:GOTO220 ELSEIFK=202 THEN
RUN ELSE300
  320 DEFPROCwindow1
  330 VDU28,0,30,25,22
  340 ENDPROC
  350 DEFPROCwindow2
  360 VDU28,0,31,39,31
  370 ENDPROC
  380 DEFPROCaxes
  390 MOVE20,350:DRAW20,965
  400 MOVE16,350:DRAW16,965
  410 MOVE5,365:DRAW800,365
  420 MOVE5,361:DRAW800,361
  430 FORL=176TO800STEP156
  440 MOVEL-78,365:DRAWL-78,375
  450 MOVEL,365:PLOT21,L,965
  460 NEXT
  470 FORL=485TO965STEP120
  480 MOVE20,L-60:DRAW30,L-60
  490 MOVE20,L:PLOT21,800,L
  500 NEXT
  510 ENDPROC
  520 DEFPROCscale
  530 VDU28,0,31,39,0
  540 PRINTTAB(0,0);Yfs:PRINTTAB(25
,20);Xfs
  550 PROCwindow2
  560 ENDPROC
  570 DEFPROCtable
  580 PROCwindow1
  590 CLS
  600 PRINTTAB(0,2);"A0";TAB(0,3);"
A1";TAB(0,4);"A2";TAB(0,5);"A3";TAB
(0,6);"A4";TAB(0,7);"A5"
  610 PRINTTAB(4,0);"f1(x)";TAB(11,
0);"f2(x)";TAB(18,0);"f3(x)"
  620 PRINTSTRING$(26,"-")
  630 ENDPROC
  640 DEFPROCgetdata
  650 @%=10
  660 PROCwindow2
  670 INPUT"Enter No. of data point
s (0 to 12)",N:IFN<2 ORN>12 THEN670
  680 i=2
  690 DIMA(N,N),B(N),C(N),X(N),Y(N)
,S(N),E(N)
  700 INPUT"Enter X full-scale",Xfs
  710 INPUT"Enter Y full-scale",Yfs
  720 PROCscale
  730 FORI=1TON
  740 PRINT"Enter X,Y of point ";I;
:INPUTX(I),Y(I)
  750 PROCplot(X(I),Y(I))
  760 PROCtabulate(X(I),Y(I))
  770 NEXT
  780 ENDPROC
  790 DEFPROCplot(X,Y)
  800 XX=20+780*X/Xfs:YY=365+600*Y/
Yfs
  810 MOVEXX-8,YY-8:DRAWXX+8,YY-8
  820 DRAWXX+8,YY+8:DRAWXX-8,YY+8:D
RAWXX-8,YY-8
  830 ENDPROC
  840 DEFPROCtabulate(X,Y)
  850 VDU28,0,31,39,0
  860 @%=&20206
  870 PRINTTAB(27,i*I+1),X,Y
  880 @%=10
  890 PROCwindow2
  900 ENDPROC
  910 DEFPROCpolynomial
  920 PROCcleararrays
  930 Y1=0
  940 FORJ=1TON:FORI=1TOD
  950 B(I)=B(I)+Y(J)*X(J)^I
  960 FORK=1TOD
  970 A(I,K)=A(I,K)+X(J)^(I+K)
  980 NEXTK
  990 S(I)=S(I)+X(J)^I
 1000 NEXTI
 1010 Y1=Y1+Y(J)
 1020 NEXTJ
 1030 FORI=1TOD:FORJ=1TOD
 1040 A(I,J)=A(I,J)-S(I)*S(J)/N
 1050 NEXTJ
 1060 B(I)=B(I)-Y1*S(I)/N
 1070 NEXTI
 1080 FORK=1TOD
 1090 R=K:A1=0
 1100 FORL=K TOD
 1110 A2=ABS(A(L,K))
 1120 IFA2 >A1 THENA1=A2:R=L
 1130 NEXTL
 1140 IFA1=0 PRINT"Zero co-efficien
t in A matrix":END
 1150 IFR=K THEN 1200
 1160 FORJ=K TOD
 1170 X1=A(R,J):A(R,J)=A(K,J):A(K,J
)=X1
 1180 NEXTJ
 1190 X1=B(R):B(R)=B(K):B(K)=X1
 1200 FORI=K TOD
 1210 M=A(I,K)
 1220 FORJ=K TOD
 1230 IFI=K THENA(I,J)=A(I,J)/M ELS
E A(I,J)=A(I,J)-M*A(K,J)
 1240 NEXTJ
 1250 IFI=K THENB(I)=B(I)/M ELSEB(I
)=B(I)-M*B(K)
 1260 NEXTI,K
 1270 E(D)=B(D)
 1280 FORK=1TOD-1
 1290 I=D-K:S1=0
 1300 FORJ=1TOD
 1310 S1=S1+A(I,J)*E(J)
 1320 NEXTJ
 1330 E(I)=B(I)-S1
 1340 NEXTK
 1350 S1=0:FORI=1TOD
 1360 S1=S1+E(I)*S(I)/N
 1370 NEXTI
 1380 E(0)=FNA(Y1/N-S1)
 1390 FORL=1TOD:E(L)=FNA(E(L)):NEXT
 1400 ENDPROC
 1410 DEFPROCtabfunction
 1420  IFcolumn=0 PROCtable
 1430 PROCwindow1
 1440 @%=&20206
 1450 FORL=0TOD:PRINTTAB(3+7*column
,L+2),E(L):NEXT
 1460 PROCwindow2
 1470 column=column+1:IFcolumn>2 co
lumn=0
 1480 ENDPROC
 1490 DEFFNB(X)=E(0)+E(1)*X
 1500 DEFFNC(X)=E(0)+E(1)*X+E(2)*X^
2
 1510 DEFFND(X)=E(0)+E(1)*X+E(2)*X^
2+E(3)*X^3
 1520 DEFFNE(X)=E(0)+E(1)*X+E(2)*X^
2+E(3)*X^3+E(4)*X^4
 1530 DEFFNF(X)=E(0)+E(1)*X+E(2)*X^
2+E(3)*X^3+E(4)*X^4+E(5)*X^5
 1540 DEFPROCplotfunction
 1550 MOVE20,365
 1560 FORX=20TO800STEP4
 1570 XX=Xfs*(X-20)/780
 1580 IFD=1 YY=FNB(XX) ELSEIFD=2 YY
=FNC(XX) ELSEIFD=3 YY=FND(XX) ELSEI
FD=4 YY=FNE(XX) ELSEIFD=5 YY=FNF(XX
)
 1590 Y=365+YY*600/Yfs:IFY<368 MOVE
X,Y:GOTO1610 ELSEIFY>965 ENDPROC
 1600 DRAWX,Y
 1610 NEXT
 1620 ENDPROC
 1630 DEFPROCreplot
 1640 CLG:PROCaxes
 1650 FORL=1TON
 1660 PROCplot(X(L),Y(L))
 1670 NEXT
 1680 PROCwindow1
 1690 CLS
 1700 PROCtable
 1710 column=0
 1720 ENDPROC
 1730 DEFPROCcleararrays
 1740 FORL=1TON
 1750 B(L)=0:C(L)=0:S(L)=0:E(L)=0
 1760 FORLL=1TON
 1770 A(L,LL)=0
 1780 NEXTLL,L
 1790 ENDPROC
>
```

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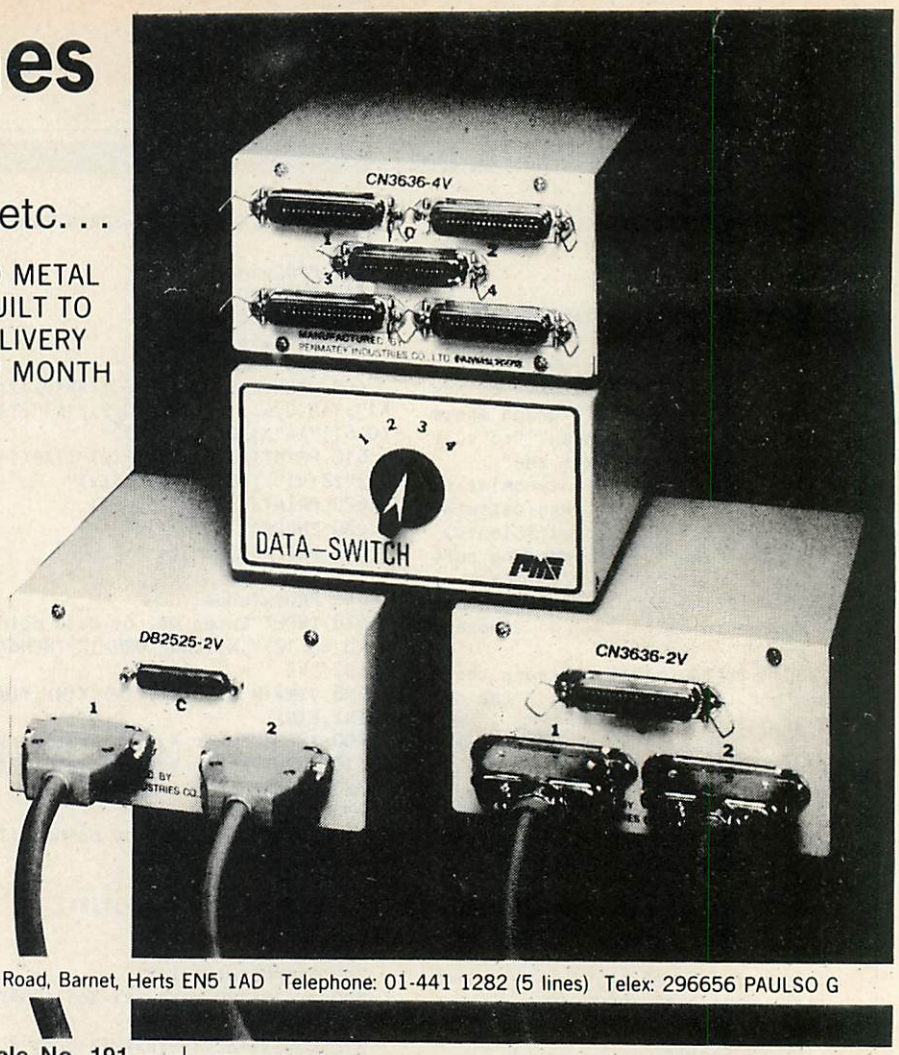

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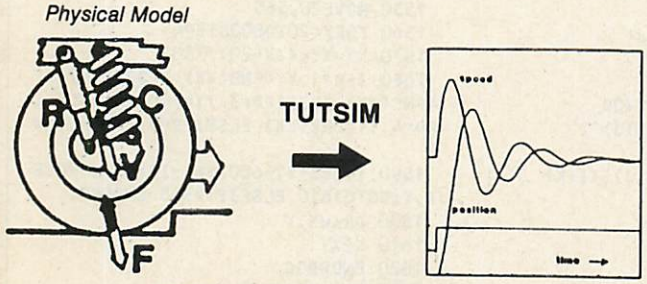

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THE PHOENIX TAPE

WHEN DID YOU last accidentally type New and destroy a program? The odds are that has not happened yet, but it will and there is no harm in being prepared.

When Basic wipes out a program, it just tells itself the program is no longer there. David Shackelton has provided a routine for Basic 4 users which will recover the program, provided that having typed New, you load it immediately. Typing anything else could well seal the program's fate.

However, the Basic listing is not the program you should load! This would overwrite anything already in the computer. Instead, type it in now, check it over and then run it. This will put the program into the cassette buffer area. Having done this, enter the monitor with a Sys 1024 call and save the machine code with either

```
S "0:PHOENIX",08,033A,03C1
```

for disc; or

```
S "PHOENIX",01,033A,03C1
```

for tape. Then when disaster strikes, you will be ready. Simply load the Phoenix program and enter the command Sys(826).

THE PHOENIX TAPE

```
100 REM ******************************
110 REM
120 REM        DAVID N SHACKLETON
130 REM             ROCHDALE
140 REM
150 REM           OLD FUNCTION
160 REM
170 REM ******************************

190 FOR Y=826 TO 960:READ A:POKE Y,A:NEXT
200 END

220 DATA 165,40,141,96,3,141,124,3,165,41
230 DATA 141,97,3,141,125,3,32,160,3,32
240 DATA 160,3,32,160,3,32,177,3,32,177
250 DATA 3,32,177,3,32,160,3,173,4,4
260 DATA 201,0,208,246,32,160,3,160,0,173
270 DATA 96,3,145,40,200,173,97,3,145,40
280 DATA 162,0,32,177,3,173,4,4,201,0
290 DATA 208,244,232,138,201,3,208,240,32,177
300 DATA 3,173,124,3,133,42,133,44,133,46
310 DATA 173,125,3,133,43,133,45,133,47,76
320 DATA 173,180,238,96,3,208,10,238,97,3
330 DATA 173,97,3,201,128,240,1,96,0,238
340 DATA 124,3,208,249,238,125,3,173,125,3
350 DATA 201,128,240,240,96
```

TYPING SPEED TEST

HAVE YOU ever wondered how fast you can type? If so, this program from Maurice Levy will let you know. It is written for the 8000 series machines and would need only a little rewriting for use on any of the others.

When the program is run, timing starts from the moment the first key is presed and ends when the Up-arrow key is pressed, at which time the number of characters and words you typed and the speed in words per minute are displayed.

There are two Sys calls. In line 130 it generates a beep since B is set to 57386. As well as the usual cursor controls, the listing shows bell characters in lines 360 and 390. These appear as reverse field G in the strings and are best inserted by first replacing them with spaces, then going back over the line, pressing Rvs-On and the letter G. They could be omitted without spoiling the program.

TYPING TEST

```
20 REM #### TYPE TEST - CBM 8000 ####
25 REM ####  MAURICE LEVY - 1984 ####


30 GOTO 160

40 TX$="":V=0:ES=0
50 T2=TI:UC=SC+PEEK(LN)*SW+PEEK(CN)
   :NC=PEEK(UC):POKE UC,PEEK(UC)OR BS


60 GET Z$:IF Z$=""THEN 60
70 Z=ASC(Z$):POKE UC,NC:IF TG THEN T1=TI
   :TG=0
80 IF Z=13  THEN PRINT:CR=CR+1:RETURN
90 IF Z=20  THEN IF V>0 THEN PRINT Z$;
   :V=V-1:TX$=LEFT$(TX$,V):GOTO 50
100 IF Z=94  THEN PRINT:ES=1:RETURN
110 IF Z=160 THEN Z$=SP$:Z=32
120 IF Z<32 OR Z>95 AND Z<193 OR V=L1 THE
    N 50
130 V=V+1:TX$=TX$+Z$:PRINT Z$;
    :IF V=L2 THEN SYS B
140 GOTO 50


160 SC=32768:SW=80:LN=216:CN=198:BS=128
170 TG=1:L1=SW-1:L2=SW-7:AL=15:B=57386
    :CR=0:TC=0:II=0:SP$=CHR$(32)
180 SL$="":FOR I=1 TO L1:SL$=SL$+CHR$(168)
    :NEXT
190 CD$="[HOME]":FOR I=1 TO 18
    :CD$=CD$+"[DOWN]":NEXT
200 DEF FN A(A)=INT(A*100+.5)/100
210 DIM TX$(AL)
220 POKE 59468,14
230 PRINT"[CLEAR,RVS] START WHEN READY
    [RVS]     [RVOFF]< ^ >[RVS] TO END  "
240 PRINT"AUTO TIMING WITH FIRST/LAST KEY
    STROKE"
250 PRINT SL$ LEFT$(CD$,3)
260 II=II+1


270 GOSUB 40:TX$(II)=TX$:IF ES THEN 290
280 IF II<AL THEN 260
290 PRINT CD$ SL$

300 FOR J=1 TO II:TC=TC+LEN(TX$(J)):NEXT
    :TC=TC+CR:IF TC<5 THEN 360
310 TM=(T2-T1)/60:MN=INT(TM/60)
    :SN=TM-(MN*60)


320 PRINT"TOTAL TIME          "MN"MINS "FN
    A(SN)"SECS"
330 PRINT"TOTAL CHARACTERS "TC
340 PRINT"TOTAL WORDS      "FN A(TC/5)
350 PRINT"WORDS PER MINUTE "FN A(TC/5/(TM
    /60))
360 PRINT"[RVS]RESTART [RVOFF]<RETURN>
    [RVS]     [RVOFF]<ESCAPE>[RVS]
     TERMINATE[BELL]"


370 GET Z$:IF Z$=""THEN 370
380 IF Z$=CHR$(13)THEN PRINT"[CLEAR]":RUN
390 IF Z$=CHR$(27)THEN PRINT"[BELL2,CLEAR]
    ":SYS 54198
400 GOTO 370
```

EXECUTING STRINGS

TO SET UP a Basic statement as a string and execute it is something many wish they could do. For instance, in a graph program, to be able to Input an expression and use it in the program would be very useful.

This short machine-code routine makes this easy. There are versions for the 64, Basic 2 and 4. The code sits in the cassette buffer area, but

(continued on next page)

(continued from previous page)

could be located anywhere. The Data value in line 1000 determines the starting location.

Any valid Basic statement can be included in the string. Imagine a string

```
A$="ANGLE=20*(SIN(T/G))"
```

To execute it use

```
SYS(DO)A$
```

Where the variable DO was set up in the Basic loader. For a graphing program:

```
INPUT "EXPRESSION"; E$
SYS(DO)"X="+E$
```

will set X to the result of the expression in E$.

KILLING THE BUMPS

COMMODORE disc drives sometimes make the most horrendous scraping noises when a read error occurs. These are affectionately known as the "bumps" and are caused by the drive forcing the head against an end-stop.

This bumping should occur only rarely, but many discs protected against copying contain deliberately recorded errors, which cause the drive to bump away like fury while loading. This can damage the drive; the 1541 in particular can be thrown out of alignment by repeated bumping. Obviously it is worth finding a way to avoid bumping.

The simple bump-killer routine is well worth saving on to a disc prior to loading one of these protected discs. It could save your drive's life.

There are only two lines; choose the second line appropriate for your drive. If the drive is reset either by turning off and on again or through software, the bumps will be re-enabled.

BASIC LINE COUNTER

MIKE HART has sent in a routine to show how many Basic lines there are in a program. The utility program sits in the cassette buffer and is run by Sys(828).

As written, the program is for the Commodore 64, but by changing lines 10 and 21 it will run on almost any Commodore machine.

	Vic	Basic 2	Basic 4
10	as is	165,41	165,41
21	205,221	217,220	131,207

Data for lines 10 and 21.

LINE COUNTER

```
1 REM  ***  LINE-COUNT - M. C. HART ***
5 REM  ***    SYS 828 TO ACTIVATE   ***

7 FOR J=828 TO 905:READ X:POKE J,X:NEXT

10 DATA 165,44

12 DATA 133, 89,169,  0,133, 88
13 DATA 133, 35,133, 36,160,  0,177, 88
14 DATA 240,  8,230, 88,208,246,230, 89
15 DATA 208,242,200,177, 88,200, 17, 88
16 DATA 240, 19,230, 35,208,  2,230, 36
17 DATA  24,169,  5,101, 88,133, 88,144
18 DATA 219,230, 89,176,215,165, 36,166
19 DATA  35, 32

21 DATA 217,220

23 DATA 162,  5,189,132,  3, 32,210,255
24 DATA 202, 16,247, 96, 83, 69, 78, 73
25 DATA  76, 32
```

EXECUTING STRINGS

BASIC LOADER

```
100 read do: i=do
110 read x
115 if x<256 then poke i,x: c=c+x:i=i+1:goto110
120 if x<>c then print"checksum error"

 999 rem  *******      C64 VERSION
1000 data 828
1010 data  32,158,173, 32,166,182,168,169
1015 data   0,240,  2,177, 34,153,  0,  2
1020 data 136, 16,248,165,122, 72,165,123
1025 data  72,160,  0,132,122,169,  2,133
1030 data 123, 32,121,165, 32,115,  0, 32
1035 data 237,167,104,133,123,104,133,122
1040 data  96,    5364

 999 rem  *******   BASIC2 VERSION
1000 data 828
1010 data  32,159,204, 32,128,213,168,169
1015 data   0,240,  2,177, 31,153,  0,  2
1020 data 136, 16,248,165,119, 72,165,120
1025 data  72,160,  0,132,119,169,  2,133
1030 data 120, 32,149,196, 32,112,  0, 32
1035 data   0,199,104,133,120,104,133,119
1040 data  96,    5219

 999 rem  *******   BASIC4 VERSION
1000 data 634
1010 data  32,152,189, 32,184,199,168,169
1015 data   0,240,  2,177, 31,153,  0,  2
1020 data 136, 16,248,165,119, 72,165,120
1025 data  72,160,  0,132,119,169,  2,133
1030 data 120, 32,251,180, 32,112,  0, 32
1035 data 133,183,104,133,120,104,133,119
1040 data  96,    5442
```

SOURCE CODE

```
                          C64----------BASIC2--BASIC4
                FRMEVL  = $AD9E        ;$CC9F   $BD98
                FREFAC  = $B6A6        ;$D580   $C7B8
                CRUNCH  = $A579        ;$C495   $B4FB
                GONE3   = $A7ED        ;$C700   $B785
                CHRGET  = $0073        ;$0070   $0070
                INDEX1  = $22          ;$1F     $1F
                BUF     = $0200        ;$0200   $0200
                TXTPTR  = CHRGET+7

                *=  $033C              ;$033C   $027A

033C 20 9E AD START  JSR FRMEVL        ;EVALUATE STRING
033F 20 A6 B6        JSR FREFAC        ;AND SET POINTER IN INDEX1
0342 A8              TAY               ;SAVE LENGTH OF STRING
0343 A9 00           LDA #$00          ;FORCE LAST CHAR TO 00
0345 F0 02           BEQ PUTINB        ;AND PUT IT IN BUFFER

0347 B1 22   NEXTCH  LDA (INDEX1),Y    ;GET CHAR FROM STRING
0349 99 00 02 PUTINB STA BUF,Y         ;AND TRANSFER TO BUFFER
034C 88              DEY
034D D0 F8           BNE NEXTCH        ;AND DO FOR ALL CHARS

034F A5 7A           LDA TXTPTR        ;SAVE CURRENT TXTPTR
0351 48              PHA
0352 A5 7B           LDA TXTPTR+1
0354 48              PHA
0355 A0 00           LDY #<BUF         ;AND SET TXTPTR TO BUF
0357 84 7A           STY TXTPTR
0359 A9 02           LDA #>BUF
035B 85 7B           STA TXTPTR+1

035D 20 79 A5        JSR CRUNCH        ;CRUNCH KEYWORDS IN STRING
0360 20 73 00        JSR CHRGET        ;GET CHAR FROM BUF
0363 20 ED A7        JSR GONE3         ;AND EVALUATE EXPRESSION

0366 68              PLA               ;RESTORE TXTPTR
0367 85 7B           STA TXTPTR+1
0369 68              PLA
036A 85 7A           STA TXTPTR
036C 60              RTS               ;AND WE'RE DONE
```

KILLING THE BUMPS

```
OPEN 15,8,15
PRINT#15,"M-W"; CHR$(106); CHR$(0); CHR$(1); CHR$(133)    ..... 1541 drive

PRINT#15,"M-W"; CHR$(92); CHR$(67); CHR$(1); CHR$(138)    ..... 4040 drive

PRINT#15,"M-W"; CHR$(245); CHR$(67); CHR$(1); CHR$(138)   ..... 1541 drive
```

PC

DISKING means business

DISKING, FREEPOST, Liphook, Hampshire, GU30 7BR. Tel (0428) 722563 (24hrs)

Unlabelled diskettes + FREE coloured diskette(s)

SEE 10 LIBRARY BOX
(capacity ten disks)

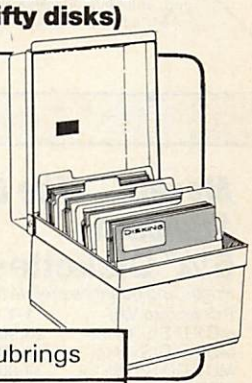
FREE with Deals A,F,L,R

BUDGET 30 STORAGE BOX
(capacity thirty disks)

FREE with Deals B,G,M,S C,H,N,T

BUDGET 50 STORAGE BOX
(capacity fifty disks)

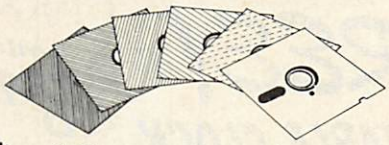
FREE with Deals D,J,P,U E,K,Q,V



Diskettes	Prices exc VAT — All diskettes individually certified & with hubrings				
	10+1 colour	20+2 colours	30+3 colours	40+4 colours	50+6 colours
1D S/S D/D 48 tpi	Deal A 15.90	Deal B 31.80	Deal C 47.70	Deal D 63.60	Deal E 79.50
2D D/S D/D 48 tpi	Deal F 17.90	Deal G 35.80	Deal H 53.70	Deal J 71.60	Deal K 89.50
1DD S/S D/D 96 tpi	Deal L 17.90	Deal M 35.80	Deal N 53.70	Deal P 71.60	Deal Q 89.50
2DD D/S D/D 96 tpi	Deal R 19.90	Deal S 39.80	Deal T 59.70	Deal U 79.60	Deal Y 99.50

ALL DEALS GET:

FREE storage box
FREE coloured diskette(s)* of your choice
FREE Pack of Disking Colour Coder Felts
FREE Blue Diskwriter Pen
FREE Black Diskwriter Pen



* *Choose from the following Colours:- Red (R), Orange, (O) Yellow (Y), Green (G), Pale Blue (B)

Please rush me the following Deal(s):-

Qty	Deal	Colour(s) required	Price exc VAT
_____ x	_____	_____	_____
_____ x	_____	_____	_____
_____ x	_____	_____	_____

Total goods value exc VAT _____
Total delivery & insurance _____
Sub Total exc VAT _____
VAT _____
Value of cheque to Disking _____

Name: _____

Address: _____

_____ tel No: _____

or please charge my credit card No: _____

Access VISA & Diners cards welcome _____

● Circle No. 178

UK shipping rates inc ins. but exc. VAT
Deals:- A,B,F,G,L,M,M,R,S 1-2 off £1.00 each, 3-5 off 80p each 6-9 off 60p each, 10+ off POST FREE
Deals:- C,D,E,H,J,K,N,P,Q,T,U,V 1-2 Off £2.00 each, 3-5 off £1.40 each 6+ POST FREE

We are main distributors for Verbatim, Memorex, Dysan and Maxell diskettes, and we sell all diskette accessories including storage boxes and cleaning kits — please telephone for price list.

DISKING means business

DISKING FREEPOST, LIPHOOK, HAMPSHIRE GU30 7BR, UNITED KINGDOM
How to contact us:
General Enquiries & Sales (0428) 722563; Trade/Government (0428) 722840; Telex 858623 Telbur G

DISKING NEWS

THE DISKING PROMISE. If you don't find us the slickest diskette supplier, we want to know. We're here to serve you, and if you're not happy, we're not! We strive to keep everything you see here IN STOCK and normally ship within four hours (YES HOURS!) A full refund if dissatisfied, goes without saying.

NEW FROM DISKING. Brighten up your office, order your own SUPERB Coloured diskettes NOW! Choose from *RED, ORANGE, YELLOW, GREEN, PALE BLUE* and *BLUE.* They come in fives of one colour, with a *FREE* SEE 10 Library Box and Colour Coders thrown in. **GET SOME — They're GREAT!**

DISKING KC (King Company) AWARD This month we are pleased to congratulate the girls at ALEXON, a lady's fashion shop in the High Street, Guildford. My wife likes these clothes, and we also like the fact that they're British! Anyway, there I sat, nodding in approval or otherwise at times being tried on, when an idea struck me on how I could escape. I'd mention coffee, and then disappear to the coffee shop, via the hi-fi & camera shop of course. Overhearing me, we were asked if we would like a cup, and being a coffee snob (not liking instant) I asked if it was real. It was, and we had it beautifully served in nice cups & saucers. Furthermore, one girl even ran across the road to A&N's to get a jacket that my wife wanted, AND they have just telephoned us to say that a blouse we ordered, is now in, only 1 working day after we ordered it!! I've no doubt that we will return to this shop, as I enjoy doing business with people who CARE — **HOW REFRESHING!**
p.s. It's a pity they couldn't trade with the front door closed — my feet were frozen.

DISKETTES

Maxell — The Gold Standard

5¼" Diskettes

Prices and quantities relate to ***Ten-Packs***

Prices exc VAT	1-4	5-9	10+
MD1-D S/S 48 tpi	23.90	22.90	21.90
MD2-D D/S 48 tpi	34.90	33.90	32.90
MD1-DD S/S 96 tpi	34.90	33.90	32.90
MD2-DD D/S 96 tpi	42.90	41.90	40.90

Certified for single OR double density. 48 tpi suitable for 35 or 40 track operation. 96 tpi suitable for 77 or 80 track operation.

8" Diskettes

Prices and quantities relate to ***Ten-Packs***

Prices exc VAT	1-4	5-9	10+
FD1-XD S/S D/Dens	32.90	31.90	30.90
FD2-XD D/S D/Dens	40.90	39.90	38.90

32 hard sector available at the same prices.

3½" Microdisks

Prices and quantities relate to ***Ten-Packs***

Prices exc VAT	1-4	5-9	10+
MF2-DD D/Sided 1.0Mb	59.90	58.90	57.90

3" Microdisks

Prices and quantities relate to ***Ten-Packs***

Prices exc VAT	1-4	5-9	10+
CF2 Compact D/S Floppy	39.90	38.90	37.90

Dysan for the Discerning

5¼" Diskettes

Prices and quantities relate to ***Ten-Packs***

Prices exc VAT	1-4	5-9	10+
104/1D S/S 48 tpi	23.90	22.90	21.90
104/2D D/S 48 tpi	34.90	33.90	32.90
204/1D S/S 96 tpi	34.90	33.90	32.90
204/2D D/S 96 tpi	42.90	41.90	40.90

Certified for single OR double density. 48 tpi suitable for 35 or 40 track operation. 96 tpi suitable for 77 or 80 track operation.

8" Diskettes

Prices and quantities relate to ***Ten-Packs***

Prices exc VAT	1-4	5-9	10+
3740/1D S/S D/Dens	32.90	31.90	30.90
3740/2D D/S D/Dens	40.90	39.90	38.90

32 hard sector available at the same prices

MEMOREX Memory Excellence

5¼" Diskettes

Prices and quantities relate to ***Ten-Packs***

Prices exc VAT	1-4	5-9	10+
3481 S/S 48 tpi	22.90	21.90	20.90
3491 D/S 48 tpi	29.90	28.90	27.90
3504 S/S 96 tpi	28.90	27.90	26.90
3501 D/S 96 tpi	36.90	35.90	34.90

Certified for single OR double density. 48 tpi suitable for 35 or 40 track operation. 96 tpi suitable for 77 or 80 track operation.

5¼" Diskettes (HIGH DENSITY)

Prices and quantities relate to ***Ten-Packs***

Prices exc VAT	1-4	5-9	10+
5500 D/S 1.6 MByte	49.90	48.90	47.90

3½" Microdisks

Prices and quantities relate to ***Ten-Packs***

Prices exc VAT	1-4	5-9	10+
6100 S/Sided 0.5Mb	42.90	41.90	40.90

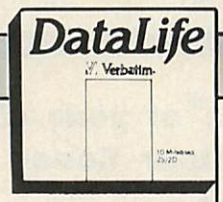
coloured diskettes

5¼" Supplied in *Five-Packs* of one colour

Prices and quantities relate to ***Five-Packs***

Prices exc VAT	1-9	10-19	20+
1D S/S 48 tpi	12.90	11.90	10.90
2D D/S 48 tpi	18.90	17.90	16.90
1DD S/S tpi	18.90	17.90	16.90
2DD D/S 96 tpi	21.90	20.90	19.90

To order the colour of your choice, just precede the type number with the appropriate letter, (R) RED, (O) ORANGE, (Y) YELLOW, (G) GREEN, (B) BLUE & (P) PALE BLUE. For the actual colours, please see our full colour advertisement back a couple of pages, or call and ask for our full colour brochure.



Verbatim Datalife = Best!

5¼" Diskettes

Prices and quantities relate to ***Ten-Packs***

Prices exc VAT	1-4	5-9	10+
MD 525-01 S/S 48 tpi	22.90	21.90	20.90
MD 550-01 D/S 48 tpi	29.90	28.90	27.90
MD 577-01 S/S 96 tpi	28.90	27.90	26.90
MD 557-01 D/S 96 tpi	36.90	35.90	34.90

Certified for single OR double density. 48 tpi suitable for 35 or 40 track operation. 96 tpi suitable for 77 or 80 track operation.

8" Diskettes

Prices and quantities relate to ***Ten-Packs***

Prices exc VAT	1-4	5-9	10+
FD 34-9000 S/S S/D	31.90	30.90	29.90
FD 34-8000 S/S D/D	31.90	30.90	29.90
DD34-4001 D/S D/D	36.90	35.90	34.90

32 Hard Sector available at same price.

3½" Microdisks

Prices and quantities relate to ***Ten-Packs***

Prices exc VAT	1-4	5-9	10+
MF350 S/Sided 0.5Mb	42.90	41.90	40.90

Verbatim Verex = Value

5¼" Diskettes

Prices and quantities relate to ***Ten-Packs***

Prices exc VAT	1-4	5-9	10+
MD200-01 S/S 48 tpi	19.90	18.90	17.90
MD250-01 D/S 48 tpi	23.90	22.90	21.90

48 tpi suitable for 35 or 40 track operation.

8" Diskettes

Prices and quantities relate to ***Ten-Packs***

Prices exc VAT	1-4	5-9	10+
FD34-1500 S/S S/D	22.90	21.90	20.90
DD34-1501 D/S D/D	29.90	28.90	27.90

32 Hard Sector available at same price.

FREE! LCD TABLE CLOCK

worth 8.95

with EVERY 20 Diskettes ordered at these prices

When you buy twenty diskettes (any size, make or type) at these prices, you will receive, completely FREE of charge, this superb calendar clock with a large easy to read 24mm LCD display. Buy forty diskettes and you will receive two clocks and so on.

Offer ends 30th April, 1985

PLUS

FREE with every Ten-pack of diskettes from DISKING (or Five-Packs if coloured disks). The Superb SEE 10 Library Box. Also available individually for £2.50 exc VAT, either for 5¼" Disks (SEE 10), or 3½" Disks (SEE 10-3). Now also available for 8" Disks (SEE 10-8) at £3.00 exc VAT.

PLUS

FREE DISKING Colour Coders
A multicoloured pack of ten fibre tipped pens for colour coding your diskette labels. Available individually at 49p exc VAT.

BARGAIN CORNER

Bargain Corner Diskettes 5¼" Diskettes

Complete with a FREE SEE 10 library box and Colour coders, these disks are certified and are from one of the manufacturers in this ad.

Prices and quantities relate to ***Ten-Packs***

Exc VAT (No hub ring)	1-4	5-9	10+
UL1D S/S 48 tpi	13.90	12.90	11.90
UL2D D/S 48 tpi	20.90	19.90	18.90
UL1DD S/S 96 tpi	20.90	19.90	18.90
UL2DD D/S 96 tpi	24.90	23.90	22.90

Suitable for single OR double density.

Exc VAT (With hub ring)	1-4	5-9	10+
UL1DHR S/S 48 tpi	14.90	13.90	12.90
UL2DHR D/R 48 tpi	21.90	20.90	19.90
UL1DDHR S/S 96 tpi	21.90	20.90	19.90
UL2DDHR D/S 96 tpi	25.90	24.90	23.90

Suitable for single OR double density. 48 tpi suitable for 35 or 40 track operation. 96 tpi suitable for 77 or 80 track operation.

Coming Soon — Flip 'n' File Diskette storage

DISKETTE STORAGE

See next month's issue — Flip 'n' File THE Diskette storage

BUDGET RANGE

only 5·90

Buy 3 of a kind and get the 4th one FREE

Budget 30
30 Minidisk capacity in smart beige brown complete with five coloured dividers.

Part No	Description	Price exc VAT
B30	30 Minidisk capacity	5.90

If buying 3 to get one FREE p&p @ 4 unit rate please

Budget Micro
30 Microdisk capacity (or 12×3" disks). Smart two-tone beige brown.

Part No	Description	Price exc VAT
BM	30 Microdisk capacity	6.90

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6·90

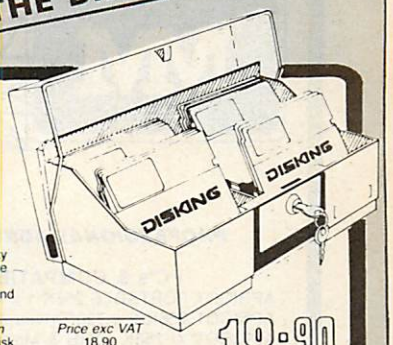
8·90 Great Value!

Budget 50
50 Minidisk capacity in smart two-tone brown, complete with four dividers and non-scratch rubber feet.

Part No	Description	Price exc VAT
B50	50 Minidisk capacity	8.90

If buying 3 to get one FREE, p&p @ 4 unit rate please.

POPULAR



Jumbo Swinger
A massive 120 minidisk capacity (with arms removed). Adjustable arms compensate for less diskettes, complete with keys and carrying handle.

Part No	Description	Price exc VAT
JUMBO	100+ Minidisk capacity	18.90

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18·90

17·90

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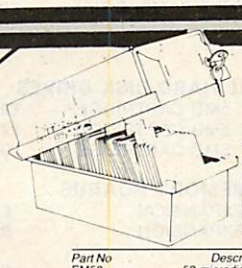
60 Minidisk capacity, complete with keys, dividers, tags and even built in carrying handles.

Part No	Description	Price exc VAT
DSLB	60 Minidisk capacity	17.90

If buying 3 to get one FREE, p&p @ 4 unit rate please.

EXECUTIVE



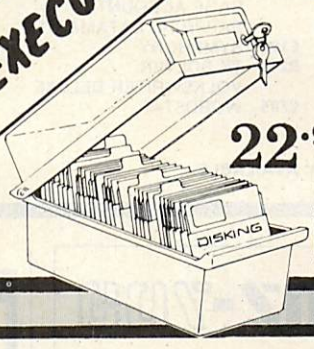
19·90

Executive Range
The ultimate in quality. Luxurious two-tone brown, with dividers, tabs, keys, removable lids — you name it!

Executive Micro 50
Fifty 3.5" microdisk capacity complete with removable lid, dividers, tabs, lock and 2 keys.

Part No	Description	Price exc VAT
EM50	50 microdisk capacity	19.90

If buying 3 to get one FREE, p&p @ 4 unit rate please.



22·90

Executive Mini 100
100 5.25" minidisk capacity complete with removable lid, dividers, tabs, lock and 2 keys.

Part No	Description	Price exc VAT
EM100	100 minidisk capacity	22.90

If buying 3 to get one FREE, p&p @ 4 unit rate please.

DISKING supermailers

These diskette mailers come packed in 100s and are of a very clever copyright design. They well hold up to 4 diskettes complete with envelopes and are extremely robust.

Part No	Description	Price exc VAT
DSM 100	Supermailers	24.90

NEW

Memorex Cleaning Kits

The latest computer care range from Memorex represent fantastic value for money, and are available individually or with a discount if purchasing all three.

Buy all three kits together, and we will reduce the total price from £18.70 to £14.90 SAVING £3.80 — A BARGAIN IF EVER WE SAW ONE!

Part No	Description	Price
MKEY	Case/keyboard cleaning kit	4.90
MTV	VDU screen cleaning kit	4.90
MDD	Disk drive head cleaning kit	8.90

Coming Soon — 3½" Cleaning kits

Postage and Packing Rates

UK Shipping Rates exc VAT

5¼" Disks or microdisks
1-2 packs each pack @ 95p
3-5 packs each pack @ 75p
6-9 pack each pack @ 60p
10+ packs POST FREE

5¼" Coloured Diskettes
1-3 5-packs 50p each pack
4-9 5-packs 30p each pack
10+ 5-packs POST FREE

8" Diskettes
1-2 packs each pack @ 1.60
3-5 packs each pack @ 1.20
6-9 packs each pack @ 90p
10+ packs POST FREE

Budget Storage
1 off £1.00 each
2-7 off 70p each
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1 off £2.00 each
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All 'SEE 10' Library Boxes
1-4 off @ 40p each
5-9 off @ 30p each
10+ off @ 20p each

Disking Diskwriters
50-pack £1.00

Disking Colour Coders
1-5 packs 25p per pack
6+ packs POST FREE

Disking Supermailers
100-pack £3.00

Memorex Cleaning Kits
1 off 60p each
2-7 off 40p each
8+ POST FREE

TRADE CORNER

FREE Aeroplane

Our latest aeroplanes have sound, so you'll have no trouble waking up those sleepy software engineers, when you throw it at them. Just call and ask for our flier, and we'll send you our latest trade pack with prices, special offers and sample unlabelled diskette. We'll also enclose a DPC (Disking Priority Customer Card) application form telling you how to buy at our 10,000 prices yet order in 50's.

How to Order:

General Enquiries & Sales: (0428) 722563
Government & Trade Sales: (0428) 722840

If in doubt at ANY time, just call and ask for Joan. She will answer any questions that you may have, even if you only want a catalogue and order form, just CALL!

Official Government Orders Welcome
We supply all Government bodies including schools, Universities, Colleges, Hospitals, the Utilities, Research Establishments, Armed Forces, the Ministries and Local Authorities world-wide. We will despatch within 4 (YES, FOUR) working hours from receipt of your official order number received either by post or by telephone and all orders are handled in the strictest confidence and to the letter. All other customers, cheque with order please payable to DISKING. If you are a large establishment and cannot raise cheques without an invoice, please post or telephone your order, and we will send a pro-forma invoice by return for your accounts department to pay against.

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FREE DISKING logobug for all orders left on the answering machine. You may call 365 days a year, 24 hours a day, and you may speak for as long as you like when you leave the following details.
1. Day-time telephone number
2. Cardholder name and address
3. Delivery (or invoice address) if different
4. Your Credit Card Number
5. What you want and how many
6. Normal or first class post

We welcome Access (Mastercharge) Barclaycard (VISA) and Diners Club International, and there is NO credit card surcharge. Alternatively you may write your credit card number on your order.

Leave the REST to US!

Urgent Orders
If you are posting your order, leave out the word FREEPOST from our address, and use our normal post code GU30 7EJ and do not forget to stamp it First Class. If you are telephoning your order, please make it clear that your wish to pay for your goods to be sent to you by First Class Post.

First Class Rates
Minidisks & Microdisks:
First Ten-Pack, £2.00. Second and subsequent Ten-Pack, £1.50.

Very Urgent Orders
If ordering by telephone, and by 3.00pm you may request Datapost which delivers the next morning at 9.00am. Minimum cost is £10.00 for the first 5kg — please call.

Desperate Orders
Just call and ask for Joan or Roger and we will do whatever we can to help you with your problem. If you are not too far we can probably organise a taxi or courier.

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MM PC PRICE BONANZA

PROFESSIONAL SERVICE ***PROMPT DELIVERY***

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COMPAQ 2 2x360K drives	£1795
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IBM PC 256K 2x360K Mono	£1865
IBM PORTABLE 256K	£1902
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UNVEILING BASIC PROGRAMS

ONE ADVANTAGE of having Basic in RAM is that it can easily be modified. Many programs start off by changing Basic in order to enable or disable certain functions: for example, a Print At capability can be added, or the Break key may be disabled. Sometimes these alterations require you to turn the computer off and then on again if you want to regain control, which can be extremely irritating.

J Leonard has provided a program for the MZ-80K that lets you see what is going on, and why your machine is behaving in the way it is. The Read Basic program loads the program you are investigating into a protect area of memory, and then examines it byte by byte to produce a listing.

The two short machine-code routines change the Load and Execute addresses of the target program and enable the printing of control characters and so on. The conversion of tokens to the keywords they represent is done using a look-up table, the array D$(),filled by Reading the Data statements.

The calls USR(39) and USR(42) invoke the SP-1002 monitor routines for reading a tape header and then reading the data constituting the program, but without invoking the Clear Memory routine associated with Load.

Finally, both the machine-code routines and the target program are stored in memory beyond the point marked off by the Limit 21700 statement. This leaves just enough room for the Read Basic program and its variables — so don't expand it without great care — and the maximum amount of space for the target program itself.

TAB$

ACCORDING TO J S Levett there are many programs for the Sharp MZ-80K which employ sequences of ■ Cursor-Right symbols to position some Printed expression on the screen. He proposes a rather interesting use of the Tab() function, instead.

Though using Print Tab(X) is naturally known for placing some number or string at column X, what is not commonly known is that in SP-5025 Basic Tab(X) itself behaves like a string. It can, therefore, be concatenated like any other string, so that it can be employed within a string instead of the relevant number of ■ characters.

For instance, instead of

```
100 PRINT "Fred■■■
```

OPEN FILE

dBASE II HELP MESSAGES

ONE very useful feature of Ashton-Tate's dBase II package which you will not find mentioned in the manual is the ability to create personalised help messages, writes Peter Clark. I started using this feature some time ago, but I have never seen it mentioned in print before.

All the help messages in the dBase II Help facility are stored in a file called Dbasemsg.TXT. It is accessible, like any .TXT file, by a normal word-processor program like WordStar, or by using the dBase II command

MODIFY COMMAND
DBASEMSG.TXT

Make sure you put in the .TXT extension every time, otherwise dBase II will create a new file called Dbasemsg.CMD — or .PRG depending whether you have the CP/M or MS-DOS version.

I will leave you to scan the file at your leisure, but you will find that the messages are stored in a very simple format. Each entry starts with a line which contains a * followed by the command name. The end of each entry is marked by a line containing *Exit.

The following example shows the entry in Dbasemsg.TXT for the Browse command

*BROWSE
> BROWSE [FIELDS <field list>] — brings up Full-screen viewing and editing of the database in use.
*EXIT

If you leave out a *Exit the help message continues. This allows you to get the same message with two different commands. So typing Help Go or Help Goto will produce the same help message because the entry in Dbasemsg.TXT is as follows

*GO
*GOTO
> GO or GOTO — positions to a specific record or place in the database in use. Also positions to record number contained in memory variable.

The syntax is

GO or GOTO [RECORD <n>],<n>,[TOP],[BOTTOM], or <memvar>
*EXIT

It is clearly very simple to edit Dbasemsg.TXT to change any existing message to your own liking. There is also nothing to stop you inserting new help messages. For example if you set up a dBase II application which uses several different command files — say, for accounts, stock control and wages — you could add the help messages shown in the box. Start with a message beginning *Help, or add to the existing one, since this is the message presented if the user simply types Help.

If you add messages to the Dbasemsg.TXT file it is advisable to put them at the beginning of the file, otherwise the Help command will take some time to find them. If you wish, you can dispense with the original help messages entirely and create a Dbasemsg.TXT file from scratch.

The Help command is fail-safe. If it cannot find a requested message it will just return a polite

NO HELP MESSAGES FOUND.

Now for the bad news. Having got yourself hooked on personalised help messages, when you upgrade from dBase II to dBase III you will find they do not work, as dBase III has an entirely different way of handling its help messages.

WORDSTAR CHARACTERS

TABLE 1

	= A0	0 = B0	@ = C0	P = D0
!	= A1	1 = B1	A = C1	Q = D1
"	= A2	2 = B2	B = C2	R = D2
£	= A3	3 = B3	C = C3	S = D3
$	= A4	4 = B4	D = C4	T = D4
%	= A5	5 = B5	E = C5	U = D5
&	= A6	6 = B6	F = C6	V = D6
'	= A7	7 = B7	G = C7	W = D7
(	= A8	8 = B8	H = C8	X = D8
)	= A9	9 = B9	I = C9	Y = D9
*	= AA	: = BA	J = CA	Z = DA
+	= AB	; = BB	K = CB	[= DB
,	= AC	< = BC	L = CC	\ = DC
-	= AD	= = BD	M = CD	] = DD
/	= AF	? = BF	O = CF	_ = DF

LARGE CHARACTERS IN WORDSTAR

MANY dot-matrix printers are quite capable of producing spectacular large-size characters without programming, simply using WordStar. Colin Hamer has developed large-size Greek, Arabic and Hebrew character sets in this way, as well as the familiar Roman one.

dBASE II HELP

```
*HELP
> The following application programs are available to you:-
      ACCOUNTS

      STOCK

      WAGES
To  run  a program type DO followed by the program  name  eg.
DO WAGES
To  gain further information about the facilities available  type
HELP followed by the name of the program eg. HELP ACCOUNTS
*EXIT
*ACCOUNTS
> This program gives access to the accounting system etc. etc.

*EXIT
*STOCK

_........ and so on .....
```

For this to work your printer must have graphics characters available, and since character sets are not standard the exact procedure will differ with different printers. Colin Hamer uses the Microline 82A, but the description which follows will convey the general technique to users of other suitable printers.

First of all you have to run the WordStar Install program to set up two user-defined functions to turn the graphics character set on and off. WordStar command Ctrl-P W is set to transmit hex 0E to the Microline to start graphics characters, while Ctrl-P R is set to turn them off with hex 0F.

Once back running WordStar normally you simply hit Ctrl-P W whenever you want to put a giant heading into your document. What you then have to do is type in the appropriate four-by-four set of characters which, interpreted by the printer as graphics blobs, will produce the giant character you require.

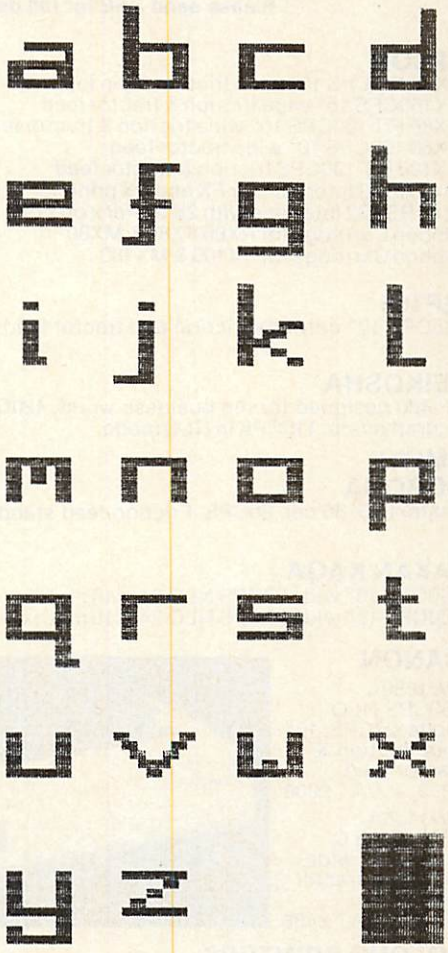
Table 1 shows the characters you type in, the hex value sent to the printer, and the shape actually printed. For example, ? produces a thick vertical blob, 5 an L shape and @ a white space.

We also show parts of the Greek and Roman alphabets, with the characters you have to type in, to demonstrate the principle of forming letters. When you want to return to entering normal text into your document type Ctrl-P R. PC

WORDSTAR CHARACTERS

ROMAN ALPHABET

```
@@@@@@  *U@@@@  @@@@@@  @@@*U
@HLLT   *]L,T   (\LLD   (\L.U
*73:U   *50:U   *500P   *50:U
@@@@@@  @@@@@@  @@@@@@  @@@@@@

@@@@@@  @ OO@   @@@@@@  *U@@@
(\LLT   @*U@@   (\L.T   *]L,T
*733Q   @+WA@   *50:U   *U@*U
@@@@@@  HNE@@    OO:U   @@@@@@

@ P@@   @ P@@   *U@@@   @*U@@
@(T@@   @(T@@   *UO\D   @*U@@
@*5@@   @*U@@   *WI$P   @*5O@
@@@@@@  LNE@@   @@@@@@  @@@@@@

@@@@@@  @@@@@@  @@@@@@  @@@@@@
(\(,T   (\L,T   (\L,T   (\L,T
*UC*U   *U@*U   *50:U   *50:U
@@@@@@  @@@@@@  @@@@@@  *U@@@

@@@@@@  @@@@@@  @@@@@@  @ P@@
(\L.T   (\LLD   (\LLD   @.]D@
*50:U   *U@@@   "33:U   @*5O@
@@@*5   @@@@@@  @@@@@@  @@@@@@

@@@@@@  @@@@@@  @@@@@@  @@@@@@
(T@(T   .P@ \   (T@(T   H4@8D
*50:U   @K(G@   *5(:U    \C,P
@@@@@@  @@@@@@  @@@@@@  @@@@@@

@@@@@@  @@@@@@  @@@@@@  ?????
(T@(T   HLL(D   @@@@@@  ?????
*50:U    (3OP   @@@@@@  ?????
(40:U   @@@@@@  @@@@@@  ?????
```



WORDSTAR CHARACTERS

GREEK ALPHABET

ALPHA	@:5@ (W+T)_/=		ZETA	CC?_ @)_@)?OO		MU	?U*? ?+W? ?*U?		TAU	J+WE @*U@ @*U@	
BETA	?CC] ?LLQ ?OO]		ETA	?@@? ?LL? ?@@?		NU	?5@? ?K4? ?@+?		UPSILON	/5:_ B+WA @*U@	
GAMMA	?CC@ ?@@@ ?@@@		THETA	8^-4 ?HD? K-^G		XI	JOOE @LL@ (((T		PHI	8+W4 ?*U? K.]G	
DELTA	@:5@ (U*T)OO=		IOTA	@*U@ @*U@ @*U@		OMICRON	8^-4 ?@@? K-^G		CHI	/5:_ ";7Q)W+=	
EPSILON	?CCA ?LL@ ?OOP		KAPPA	?(^G ?^4@ ?@+=		PI	?CC? ?@@? ?@@?		PSI	?*U? ?*U? K/_G	
LAMDA	@:5@ (EJT)@@=		SIGMA	+SCE @3]@ :1OT		RHO	?CCU ?LLE ?@@@		OMEGA	8GK4 ?@@? ;T(7	

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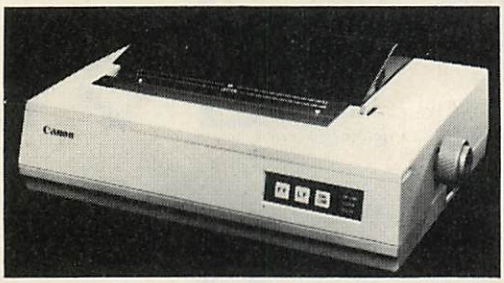

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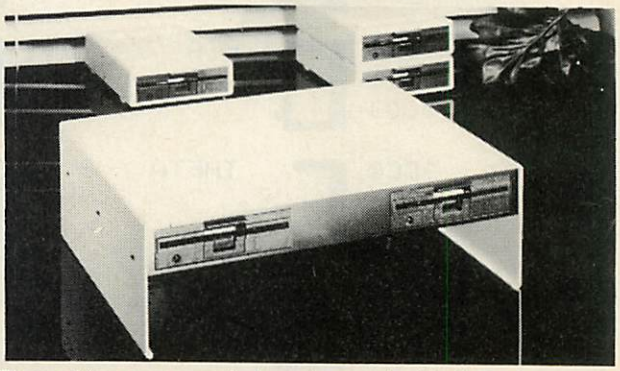

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Take it from the top

Boris Allan challenges the way programming is being taught.

I ATTENDED a meeting of the British Computer Society where the main speaker, a university lecturer in computer studies, claimed that even after three years' teaching most of his graduates were very poor programmers. He seemed to believe that this was some measure of his students' intelligence, and not of his teaching abilities.

If you take this assertion in conjuction with the oft-repeated and rather smug statement that lecturers would prefer that undergraduates had no previous programming experience, it would seem that there is something amiss. Furthermore, if you add the common computer-studies view that programming in Basic is the computing kiss of death, you might ask for some justification. On examination, it seems there is little justification other than the usual desire to add mystique to your endeavours.

Sensible methodology

What computer studies seems to want is a tabula rasa on which to write good programming practices. Given the wide number of languages now in use outside higher education, the teaching of any particular programming language needs no justification other than that it is capable of being used for the teaching of generally applicable sensible programming methodologies.

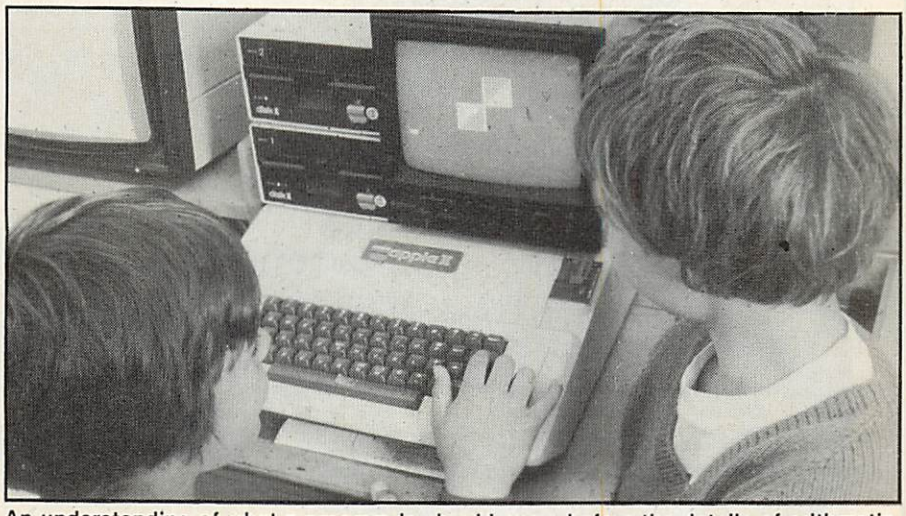
To teach a language purely because it is used "out there" does not make sense, because once you have learnt how to program it is simple to change to other languages. There has been been work which indicates that learning, say, Pascal helps in writing more compact and efficient Cobol programs. Languages such as the older versions of Basic are not as susceptible to economical programming as Pascal, though newer versions are becoming far better suited.

The unsuitability of Basic as a means of learning top-down programming is well established, though it is perfectly possible to teach systematic methods of programming with Basic: it merely requires more thought on the part of the teacher. Basic tends to encourage a bottom-up style of programming on the part of the naive user, and it is for this reason that computer-studies courses discourage the use of Basic, because it teaches bad habits.

Contradiction

The benefits of the structured approach should be so evident that students program in a structured manner at all times, especially in Basic where it is so necessary. If the students have been shown the benefits of top-down methodology, and the benefits are so clear, then why worry about programming in Basic? The reason, I suspect, is that the bottom-up teaching of Pascal programming contradicts the ethos of the top-down methodology.

If you take almost any textbook for students programming in Pascal, the sequence of topics is more or less bottom up, and the succession of topics differs little from those of Basic texts. Students are discouraged from using Basic because it promotes a bottom-up attitude, yet those same students are taught in a bottom-up manner, mainly because it is easier for the teacher.



An understanding of what a program is should come before the details of arithmetic.

These students are supposed to make the mysterious transition from bottom-up programmers to top-down methodologists. No wonder the lecturer's students were poor programmers: they had been expected to become top-down programmers after having been indoctrinated with a bottom-up methodology. The justification for the bottom-up approach to teaching Pascal is often in terms such as "you have to learn how to do everything before you can do anything".

The argument against bottom-up teaching, apart from its conflict with the later change to a top-down methodology, is that you do not need to know a great deal about arithmetic, say, in Pascal to progress. You learn the arithmetic through use in programs, because arithmetic can be examined in detail when it becomes necessary. The most important control structure in Pascal, and most other sensible languages, is the procedure. The procedure is important not only because it shortens programs, but principally because it makes programs more sensible.

Probably the most successful text on Pascal is Ken Bowles' *Problem Solving using Pascal,* 1977, and his is a top-down book, with procedures being introduced in the second chapter. Bowles' book has, in addition, two outstanding features: an interesting environment in which students can experiment — turtle graphics — and an immediacy of reaction produced by use of microcomputers. These two features imply notions which other teachers of programming might consider.

Interesting programs

The notions are, first, that students start programming immediately by writing interesting programs, and second, that students start by using procedures; learning about arithmetic, data structures, and control mechanisms is introduced later, as necessary. The result is that students start by learning to program in a top-down manner. The students do not have to unlearn the bottom-up techniques taught by their lecturers, because their lecturers have only promoted top-down methods.

It is worth noting that, using a sensible approach, Bowles finds that "In general, we have found [mathematically inadequate] students to be nearly as adept in learning to write programs and solve problems on the computer as are the students to arrive with a stronger mathematics background." As the top-down approach to teaching has a firm basis in educational theory and practice, perhaps it is about time that computer studies made an assessment of its teaching methodologies, and stopped taking the easy way out? PC

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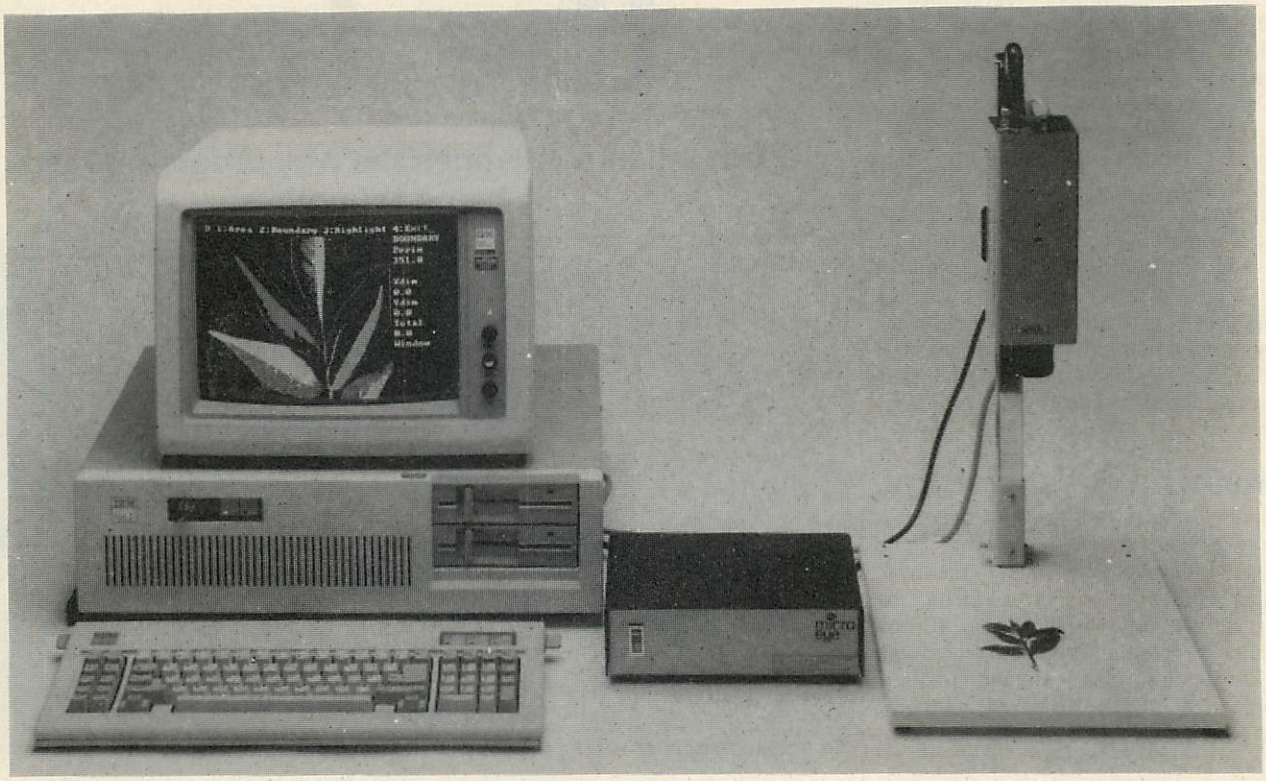

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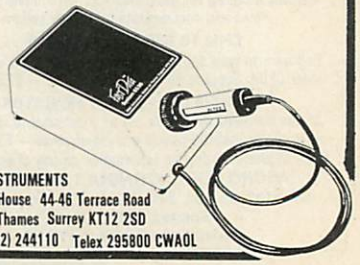

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PRACTICAL COMPUTING

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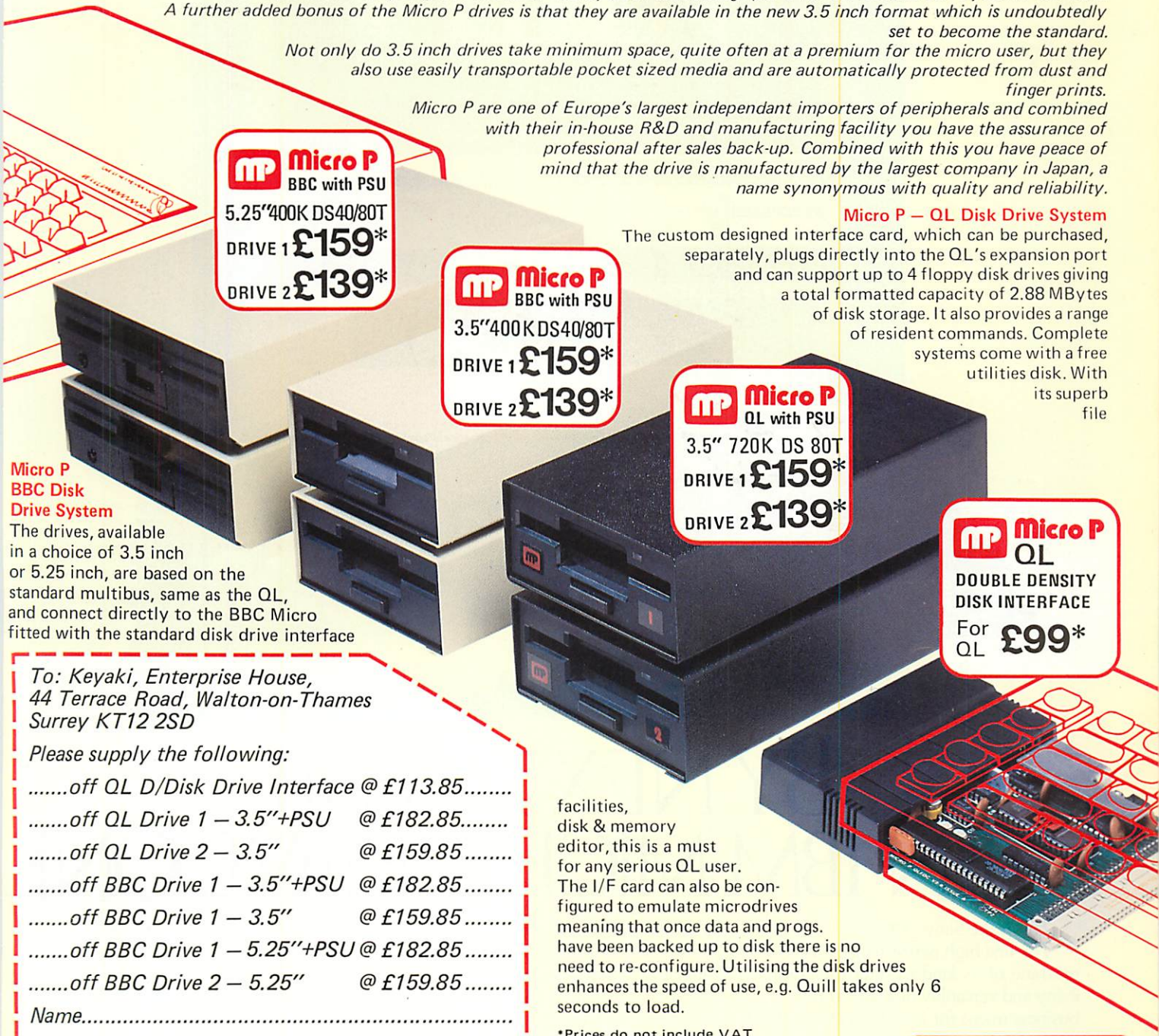

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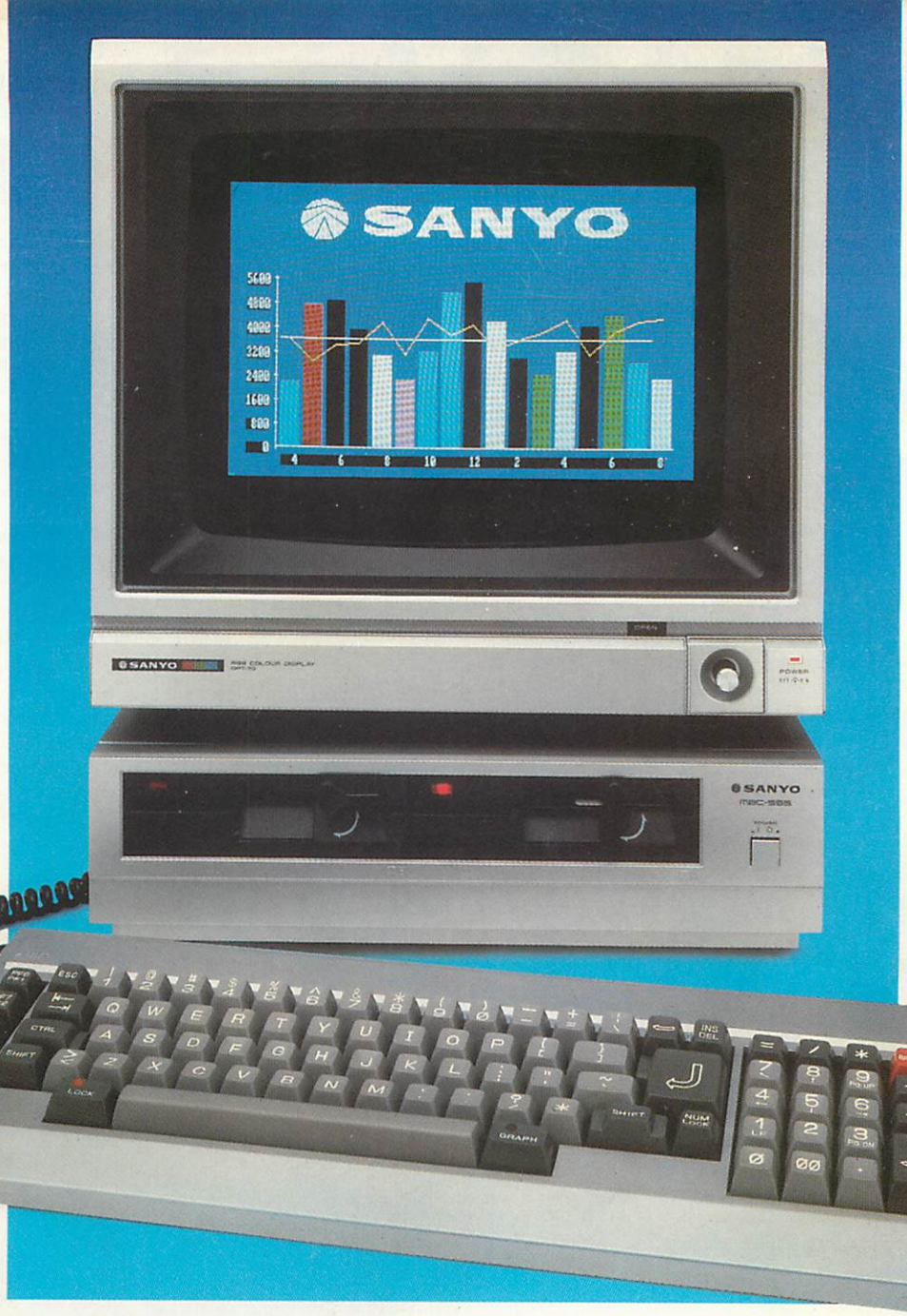

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